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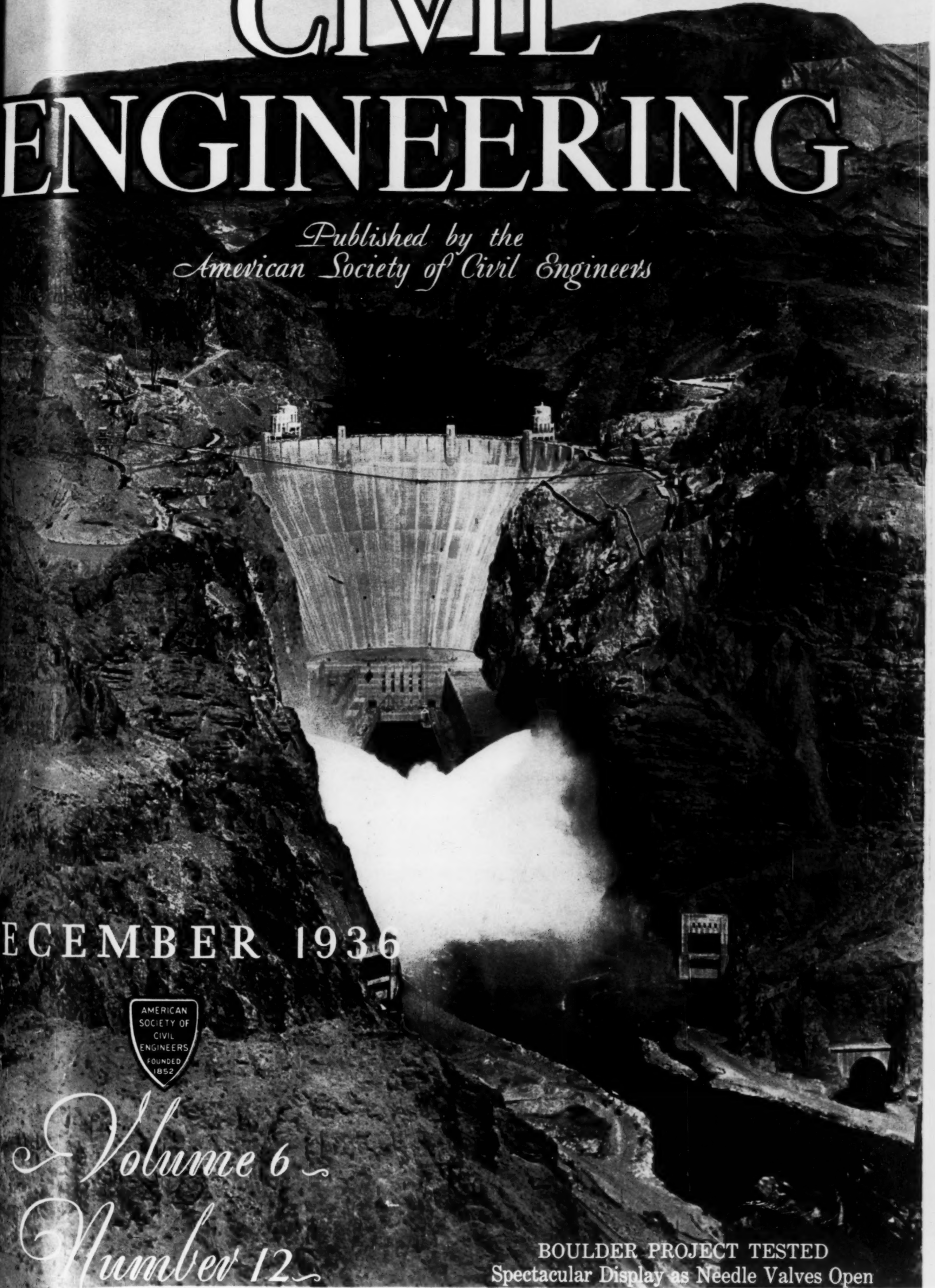

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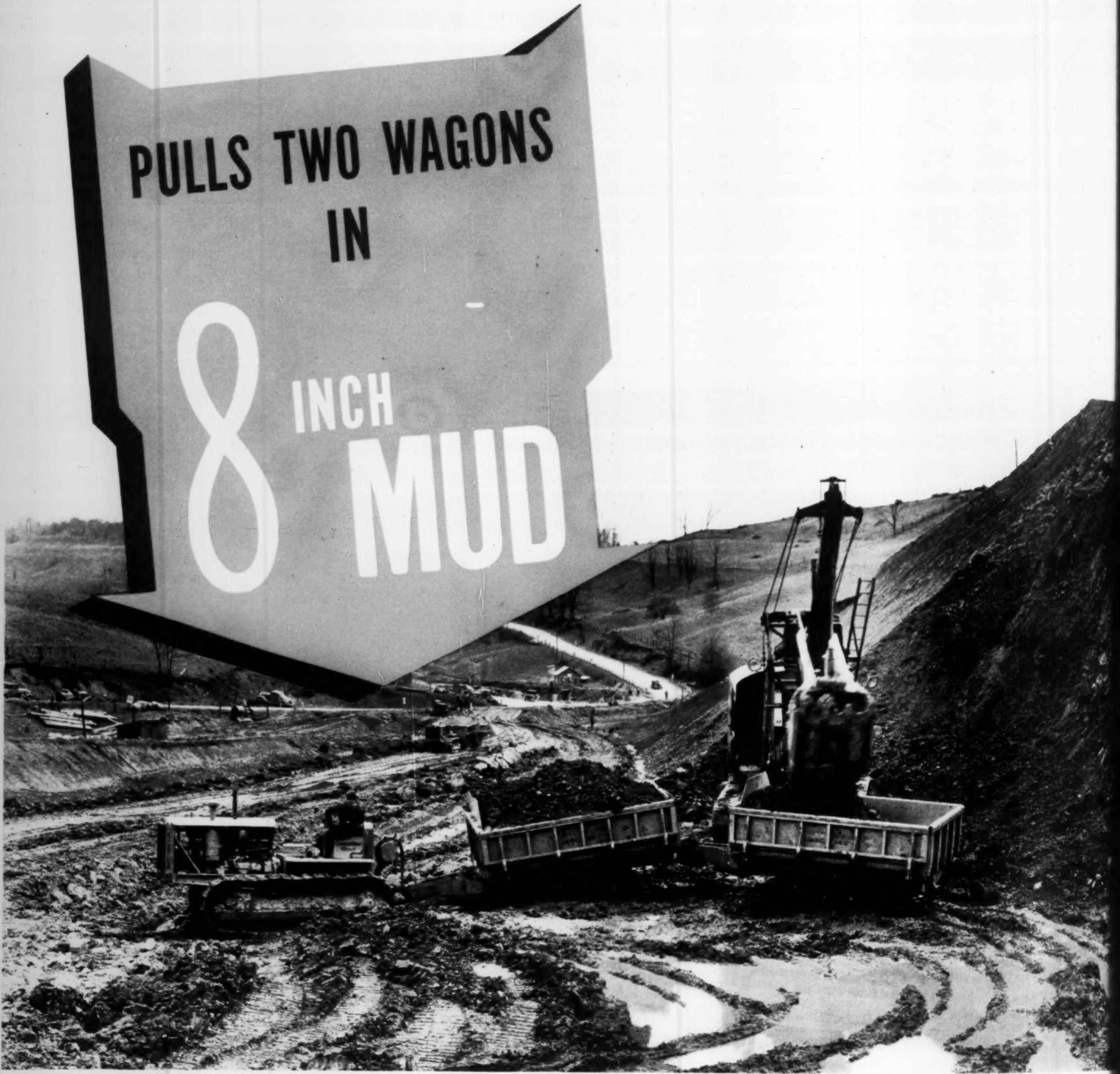
Number 12

BOULDER PROJECT TESTED
Spectacular Display as Needle Valves Open



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Number 12

BOULDER PROJECT TESTED
Spectacular Display as Needle Valves Open

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CIVIL
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DECEMBER 1936

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NUMBER 12

Sewage Treatment in New York City

Complete Control of Pollution Is Still Far in the Future, but a Promising Start Has Been Made

By WALTER D. BINGER, M. AM. SOC. C.E.
DEPUTY COMMISSIONER, DEPARTMENT OF SANITATION
and RICHARD H. GOULD, M. AM. SOC. C.E.
CHIEF ENGINEER, BUREAU OF SEWAGE DISPOSAL, DEPARTMENT OF SANITATION, NEW YORK, N.Y.

INCREASING pollution of the waters of New York City with growth of population has been a serious matter for many years, but until 1914, when the Metropolitan Sewerage Commission made its final report on means for control, the basic problem had not been faced. Even when the Department of Sanitation was created in 1929, the only operating sewage-treatment works in the entire city were eight fine-screening plants of a fairly modern type and an equal number of antiquated ones. However, a start had been made on the Coney Island and the Wards Island works. The relatively small Coney Island plant was opened on July 1, 1935, initiating the era of complete treatment. The $28,000,000 Wards Island plant is expected to go into operation in 1937, while two additional activated-sludge works are planned for the future, at Tallmans Island near Flushing Bay, and at Jamaica Bay, respectively. While no ultimate plan for pollution control has been definitely determined upon, pending agreement with the newly formed Interstate Sanitation Commission, the department has prepared several tentative plans looking toward solution of the problem with the aid of natural purification processes taking place in the harbor. However, perhaps $200,000,000 additional will have to be expended and much more time will be required to attain complete control. The following article is abstracted from the paper by Messrs. Binger and Gould, delivered by Mr. Binger on March 18, 1936, before the Metropolitan Section of the Society.

IT is recorded that in 1696 the Common Council of New York ordered estimates for "a common seuer" in Broad Street. The estimate showed that "every foot will cost fifteen shillings." From this rough beginning over a century passed until common sewers really became common. Extensive construction took place immediately after the introduction of Croton water in about 1840. The present system in Manhattan may be said to date from that time, and Brooklyn followed a few years later. The major part of the existing system in lower and central Manhattan was built within a period of about thirty years after 1840.

Before 1850 the construction and character of the sewers became subject to regulation, and sewer construction was placed in the hands of a department of the city government. Much of the early design work was done by Julius Walker Adams, sixth President of the Society.

In 1865 the state legislature passed an act authorizing the adoption of a general plan for a sewerage system. The city was divided into natural watersheds by districts, and the best lines of common sewers or outfalls were determined. This plan was changed a great deal later.

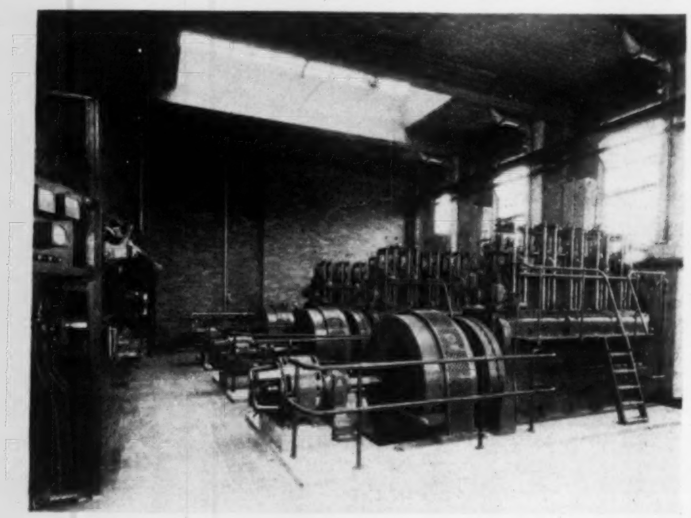
During the course of years many large trunk sewers were built in all boroughs, each draining an area of several thousand acres. This brings us to what will be recorded in future as the next great step in the history of sewers in the city, namely, the construction, now nearing completion, of the Manhattan and Bronx interceptors, draining an area of 3,335 acres and 8,135 acres, respectively. A change of function as well as of magnitude is here involved, since the sewage from these interceptors will receive complete treatment before discharge.

The history of pollution control and sewage disposal and treatment can be traced adequately for the present purpose by mentioning a few important steps. In the borough of Manhattan, which was the old city of New York, the sewer outlets terminated at the bulkhead lines. The discharge of sewage so close to the shores created offensive conditions in the slips, and in 1888 Dr. Rudolph Herring recommended that the outlets be extended to the pierhead lines. This recommendation was adopted, but the work was not entirely completed until later. During the nineties Brooklyn alone of all the boroughs now constituting the greater city made use of treatment plants. There were five of these plants of the chemical precipitation type scattered along the shore near the bathing beaches.

The problem of pollution control was first considered by the New York Bay Pollution Commission, created under an act of the state legislature in 1903 partly as a consequence of the proposed Passaic Valley trunk sewer, which was to discharge New Jersey sewage into the inner waters of New York harbor. This commission, however, went out of existence in three years without having faced the whole basic problem of pollution. It was left to the Metropolitan Sewerage Commission, created by the legislature in 1906, to win the distinction of giving the problem a base so wide that all subsequent studies might be built upon its foundation.

Three objectives were set up by this commission:

1. To establish the facts attending the discharge of sewage.
2. To determine the extent to which these conditions were injurious to the public health and welfare.
3. To ascertain the way in which it would be necessary to improve the conditions of disposal in order to meet the reasonable requirements of the present and future.



GAS ENGINES AND GENERATORS ARE OPERATED BY DIGESTER GAS AT THE CONEY ISLAND PLANT

This commission completed its work with the publication of its third and final report in 1914. Among the major accomplishments which developed from that report is the Wards Island Sewage-Treatment Works, which the Metropolitan Commission recommended should be built at its present location.

Among the other important groups which investigated sewage disposal was that of the late William M. Black, M. Am. Soc. C.E. (later chief of engineers), and Prof. Earl B. Phelps. Passing from the control of the borough presidents with various advisory committees, sewage disposal was finally placed under the Department of Sanitation, created by act of legislature in 1929 as a result of a referendum vote.

At that time the only treatment for the greater city was carried in eight fine-screening plants of a fairly modern type and eight old plants of doubtful value. At the beginning of 1935 these were still the only sewage-treatment plants in greater New York. At this same time, there existed on Wards Island an incomplete activated-sludge treatment works, consisting of concrete tanks and some piping, but with no connections to the mainland, without buildings or intercepting sewers, and practically without machinery. There was also under construction a relatively small but important plant which was destined to go into operation on July 1, 1935. This was the Coney Island Sewage-Treatment Works, which, while not complete at the time of opening, 123 days after receipt of bids, nevertheless initiated the era of complete treatment.

The complete indifference to pollution which existed in New York City previous to 1935 is shown by the fact that whereas over 90 per cent of the urban population, or about seven million people, are connected to city sewers, the sewage of only about one-fifth, or 1,400,000, was handled by the screening plants, the remainder being discharged untreated. The screening plants remove about $1^1/_2$ per cent of the solids or a bare 13 tons out of a total of about 1,000 tons a day. Contrasted with this, the Coney Island Sewage-Treatment Works, operating from July 1935 to July 1936 as a sedimentation plant, although treating the sewage of 170,000 or 11 per cent of the population served by treatment, removed approximately one-fourth by dry weight of all the sewage solids taken out by the combined plants of the city. With chemical treatment, which was provided last summer, this performance was materially improved.

TIDAL MOVEMENTS BENEFICIAL

General conditions in the harbor with respect to sewage disposal form the basic consideration in design. New York City is particularly fortunate in the natural circulation of its tidal waters, since the large tidal prisms cause tremendously large flows into and out of the harbor. While this has the effect of thoroughly mixing and diffusing the lighter organic matters, the currents do not sweep clean on each tide. The actual interchange with new sea water is relatively small in spite of the influence of the Hudson and Passaic rivers, and a large part of the organic matter flowing out with the ebb tide returns again on the flood. Over considerable areas these currents do not have sufficient velocity to hold organic matter in suspension, and at periods of slack water ample opportunity is offered for deposition.

TABLE I. DISSOLVED OXYGEN IN INNER HARBOR
Percentages of Saturation from June to September

PLACE	AVERAGE RESULTS			MINIMUM RECORDED		
	1909	1914	1934	1914	1934	1909–1934
The Narrows	83	67	52	45	23	14
Upper Bay:						
Robbins Reef	71	71	42	70	16	9
Hudson River:						
Pier A	66	52	36	31	16	8
42d Street	61	50	41	24	21	5
155th Street	..	42	51	36	13	4
Spuyten Duyvil	75	77	56	64	15	6
Harlem River:						
Morris Heights	55	26	37	6	0	0
Willis Avenue	50	26	5	0	0	0
East River:						
Throggs Neck	96	68	55	47	30	24
Hell Gate	70	23*	16	14*	3	3
42d Street	68	39	16	26	3	0
Pier 10	61	39	18	19	2	1
General average	78	52	43	..	..	..

* 1924

As a result, a very large proportion of the suspended solids carried from the sewers remain on the bottom until they have become stabilized by natural biological processes or are dredged out. Such deposition is particularly noticeable in the slack water of slips and inlets. In many of these locations the dissolved oxygen is used up, and black water and odorous gases result. Many of the solids are raised to the surface intermittently by the gases of decomposition. In some of the worst locations, such as Newtown Creek, the odors arising in the summer time extend over a wide area.

The organic matter carried from the sewers is an excellent food for bacteria, which multiply very rapidly. These bacteria require in their metabolism large quantities of the normal dissolved oxygen, which is thus greatly depleted throughout the harbor. The extent of depletion depends on the amount of pollution and on natural conditions such as the degree of current circulation.

Annual records of dissolved oxygen, kept over a period of some twenty-five years, show that the dissolved oxygen is increasingly depleted with growth of tributary population. The general trend of the oxygen values is downward, but not uniformly so, since climatic conditions, particularly rainfall and temperature, have a marked effect on the yearly averages. Tabulations of some of these records appear in Tables I and II.

The oxygen remaining in the waters varies greatly in different sections of the harbor, and fluctuates daily, monthly, and annually, depending upon temperature, stream flow, and other climatic factors. In certain inlets and bays it is normally entirely absent in summer. This is true also of the Harlem River, the worst of the major arms of the harbor. The condition of the lower East River is little better. This condition is significant since, when the oxygen is entirely depleted, the character of bacterial action becomes anaerobic, and putrefactive bacteria give off the odorous gases of decomposition.

DANGEROUS BACTERIA PRESENT IN HARBOR

The city sewers carry not only sewage but also the germs of many diseases. The presence of sewage is evident to the eye throughout most of the harbor, in floating objects of sewage origin, in the presence of oily sleek, and in the discoloration of the normally clear water by soapy turbidity. The entire inner harbor is so loaded with dangerous bacteria that for many years the Department of Health has refused to issue permits for bathing in these waters. The only places where bathing is permitted are along the south shores of Staten Island, Coney Island, the ocean beaches of Rockaway, and in Little Neck and East Chester bays in Long Island Sound. The condition of many of these latter waters is not entirely satisfactory, in spite of the large reduction in number of bacteria which takes place as the effect of sunlight, sedimentation, and the action of other biological life.

Table II. Intensity of Sewage Pollution and Biochemical Oxygen Demand of Harbor Waters in 1934

Section	Sewage Added per Day: Gal per Acre Water Surface	Sewage Added per Day: Per Cent of Volume in Section	24-Hr B.O.D. of Harbor Water, Ppm
Hudson River—City Line to Battery	18,000	0.12	1.07
Upper Bay	24,200	0.21	1.30
Lower East River	100,000	0.78	1.35
Harlem River	250,000	4.01	2.65
Upper East River	13,800	0.14	0.94
Weighted average	30,500	0.26	1.18

One of the most important objects of sewage treatment is to permit the people of New York City to frequent waterside parks and buildings near the waterfront and to travel on the waters without encountering visual evidence of sewage. It goes without saying that stenches arising from septic decomposition in the waters cannot be tolerated.

The desirability of using certain sections of the harbor for recreation would seem to warrant adequate sewage treatment. What makes it even more important is that some of the present bathing places cannot be continued in use unless such action is taken.

Not everyone will agree as to just what standards of purity the waters should meet. The act which created the Interstate Sanitation Commission, representing the states of New York, New Jersey, and Connecticut, divides the waters of the metropolitan district into two classes and specifies the minimum degree of treatment for sewage discharged into each. Its general requirements are not inconsistent with those of the Metropolitan Sewerage Commission, which set up the following general standards in 1914:

"1. Garbage, offal, or solid matter recognizable as of sewage origin shall not be visible in any of the harbor waters.

"2. Marked discoloration or turbidity, due to sewage or trade wastes, effervescence, oily sleek, odor, or deposits shall not occur except perhaps in the immediate vicinity of sewer outfalls, and then only to such an extent and in such places as may be permitted by the authority having jurisdiction over the sanitary condition of the harbor.

"3. The discharge of sewage shall not materially contribute to the formation of deposits injurious to navigation.

"4. Except in the immediate vicinity of docks and piers and sewer outfalls, the dissolved oxygen in the water shall not fall below 3.0 cc per liter of water. Near docks and piers there should always be sufficient oxygen in the water to prevent nuisance from odors.

"5. The quality of water at points suitable for bathing and oyster culture should conform substantially as to bacterial purity to a drinking water standard. It is not practicable to maintain so high a standard in any part of the harbor north of the Narrows, or in the Arthur Kill. In the lower bay and elsewhere bathing and the taking of shellfish cannot be considered free from danger of disease within a mile of a sewer outfall."

Vacuum Filter for Dewatering Sludge at the Coney Island Plant

MEETING MINIMUM REQUIREMENTS

In order to prevent sewage from being visible to the eye, it is necessary that all large-sized particles be removed—in other words, that all sewage be treated. A substantial portion of the organic content of the sewage must be removed in order to maintain suitable aerobic conditions, prevent sludge deposits, and limit excessive bacterial growths. With the removal of the organic content, a substantial portion of the total bacteria is also removed. In the highest forms of treatment, such as activated sludge, more bacteria than solids may be removed. In areas where bathing is to be permitted, sterilization of the effluent with chlorine is necessary. The harbor itself acts as a large sewage-treatment plant. It appears wise to utilize this natural assimilative capacity to a reasonable extent, since it is not practicable to treat 100 per cent of the sewage all the time.

Determining the extent to which it will become necessary to remove the organic load from the harbor in future is subject to many variables. Under existing conditions it does not appear safe to use, without review, certain values of oxygen demand in use elsewhere. Competent technical opinion is not entirely in accord on this point.

The quantitative determination of the oxygen demand of sewage is dependent on the time that the organic matter remains within harbor limits. This time of contact, for the liquid as well as for solids in suspension, can be approximately determined from a careful study of stream-flow records and chemical analyses of the harbor waters. Accurate determination of the oxygen demand of sludge deposits is more difficult but it nevertheless appears to be vital. It is also rather difficult to determine accurately the amounts of oxygen supplied to the harbor by stream flow, by tidal currents, and from the air. All these elements are, however, susceptible of approximate computation. In addition we have records indicating the actual effect of increasing pollution under a relatively fixed natural condition. With these data we can compute with reasonable accuracy the extent to which sewage must be purified to maintain a proper balance of oxygen as well as the degree of sewage treatment required for the different sections of the harbor.

Diffusion of pollution by the tidal currents makes it possible to treat the entire problem as a whole and to vary the degree of treatment in specific locations. A high degree of treatment where it is economically possible, as on Wards Island for example, permits us to utilize a much simpler form in congested areas.

TABLE III. PROPOSED TREATMENT PROJECTS, NEW YORK CITY

Numbers Refer to Locations Shown in Fig. 1

Project	Ultimate Capacity in Mgd	Project	Ultimate Capacity in Mgd
Manhattan:		Brooklyn:	
1. Wards Island	426	20. Coney Island	140
2. East 41st Street	40	21. Owl's Head	193
3. East 19th Street	28	22. Red Hook	22
4. Delancey Street	18	23. Adams Street	35
5. Roosevelt Street	28	24. Broadway	25
6. Fulton Street	10	25. Newtown Creek	83
7. Canal Street	13	26. 26th Ward	60
8. West 23d Street	16	Queens:	
9. West 46th Street	24	27. Tallmans Island	70
10. West 72d Street	22	28. Jamaica	130
11. West 96th Street	22	29. Rockaway	18
12. West 129th Street	23	Richmond:	
13. Fort Washington	16	30. Port Richmond	45
14. Dyckman Street	17	31. Stapleton	13
		32. Quarantine	5
The Bronx:		33. South Beach	9
15. Manida Street	80	34. Oakwood Beach	6
16. Classon Point	86	35. Princess Bay	5
17. Baxter Creek	19	36. Tottenville	3
18. City Island	1	37. Fresh Kills	8
19. Riverdale	2	38. Bloomfield	4

No final plan for sewage treatment has been fixed upon definitely, nor is this particularly desirable until the three states are in complete accord. However, several tentative plans have been made, such as that shown in Fig. 1. Data on the proposed treatment projects shown in Fig. 1 are listed in Table III. Upon the development of further studies and the collection of additional data we shall be able to define more exactly the degree of treatment that will be needed at each plant to be built by the City. The final solution of course will take into account the conditions that can be expected as a result of the flow coming from other New York State and New Jersey communities now polluting the waters of the metropolitan district jointly with New York City. The newly formed Interstate Sanitation Commission should have a clarifying influence.

PLANTS AT CONEY ISLAND AND WARDS ISLAND

At the present time New York City has two major sewage-treatment projects under construction, both with PWA funds. One is at Wards Island, the other, in full operation and practically completed, at Coney Island. These plants illustrate the fact that conditions in greater New York are of a variety which might not be found elsewhere except in a number of cities remote from each other.

The Coney Island plant, with a present daily capacity of 35,000,000 gal and an ultimate capacity of 140,000,000 gal on the same site, has its outfall almost on the open ocean. Conditions in the winter are those of any other exposed ocean shore, but in the summer Coney Island is perhaps the most frequented strip of beach in the world. For this reason the department selected a flexible type of plant. The winter treatment is plain sedimentation, while during the bathing season the treatment will include chemical precipitation and complete chlorination. As shown on Fig. 1, the effluent is carried out from Shellbank Creek through an 8,000-ft submarine outfall into the deep waters of Rockaway Inlet, there to mix with the tidal run. After 18 months of operation, Shellbank Creek, which was highly polluted, has become free from nuisance, with clear waters suitable for bathing.

Towing to sea is desirable and simple in the summer, but owing to the exposed location and the ice which forms in Shellbank Creek, this is sometimes impossible in the winter. Partly for this reason and partly because of other economies resulting, sludge digestion with the production of gas was determined upon. The gas is used in internal combustion engines and so far has been produced in sufficient quantity to do all the pumping. Any additional gas required will be purchased. The digested sludge will be dewatered by vacuum filter and the filter cake used as a top dressing for city parks and large expanses of vacant and unsightly land about the Sanitation Department's incinerators and similar properties. On waterfront property the liquid digested

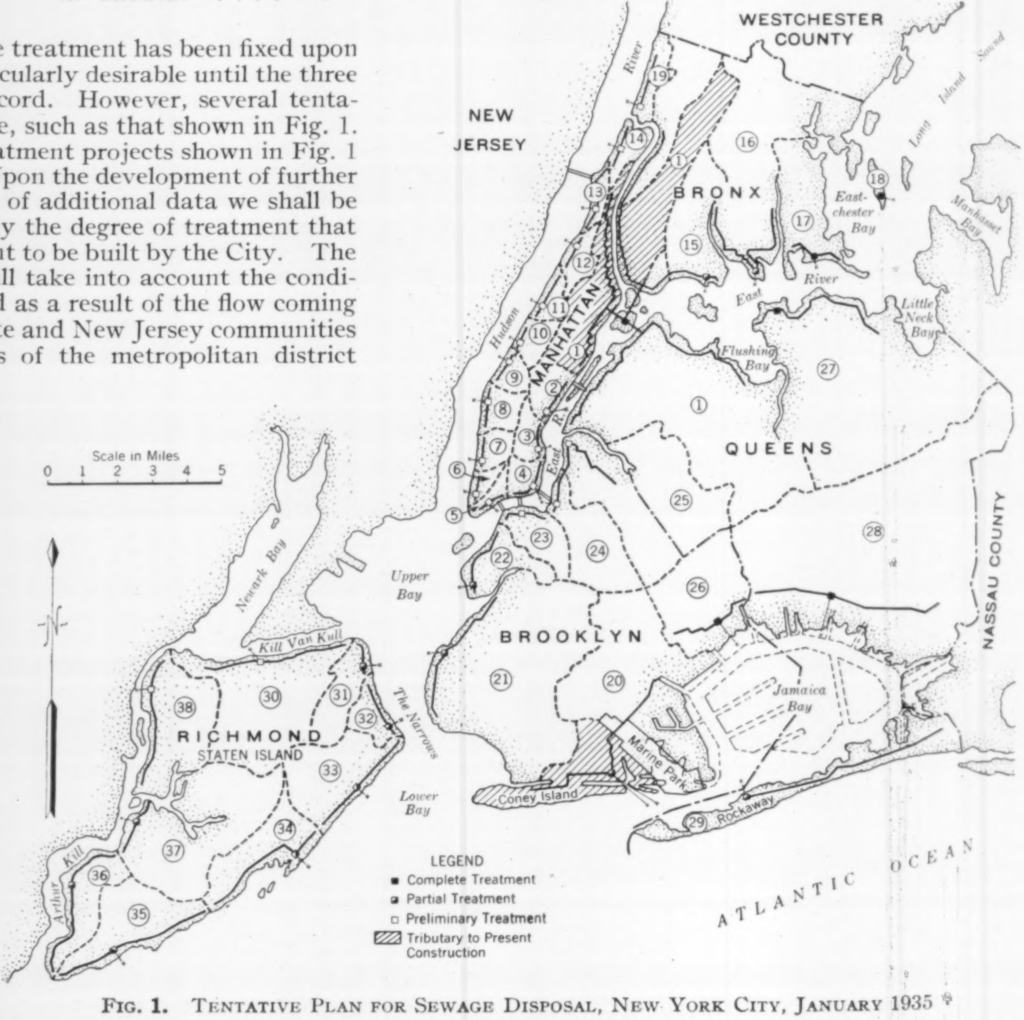

WESTCHESTER COUNTY
NEW JERSEY
Hudson River
Long Island Sound
BRONX
East-chester Bay
Manhasset Bay
East River
Little Neck Bay
Flushing Bay
MANHATTAN
East R.
QUEENS
NASSAU COUNTY
Scale in Miles
0 1 2 3 4 5
N
Newark Bay
Kill Van Kull
Upper Bay
BROOKLYN
Jamaica Bay
RICHMOND
STATEN ISLAND
The Narrows
Lower Bay
Marine Park
Coney Island
Rockaway
Arthur Kill
ATLANTIC OCEAN
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38
LEGEND
■ Complete Treatment
◪ Partial Treatment
□ Preliminary Treatment
▨ Tributary to Present Construction

FIG. 1. TENTATIVE PLAN FOR SEWAGE DISPOSAL, NEW YORK CITY, JANUARY 1935

sludge will not be filtered but pumped directly from the barges to the land.

An entirely different problem was presented at Wards Island, where a 180,000,000-gal plant empties into the restricted waters of the East River, which has practically no flow other than the oscillations of the tides. Here the city owns a large tract of cheap land, so that a large plant with a high degree of treatment constructed there will have a beneficial influence throughout the harbor and well down to Coney Island itself. Obviously a uniformly higher degree of treatment is required here than at the Coney Island plant on the ocean.

The department is here building a treatment works of the activated-sludge type, which will take the sewage from a wide area of the northeastern part of Manhattan and the southwestern part of the Bronx through interceptors and deep tunnels in rock.

The problem of sludge removal, too, is entirely different from that at Coney Island. The quantities are so great as to necessitate the use of ocean-going sludge vessels of substantial size, while the location ensures that these vessels will be able to make open water at all times.

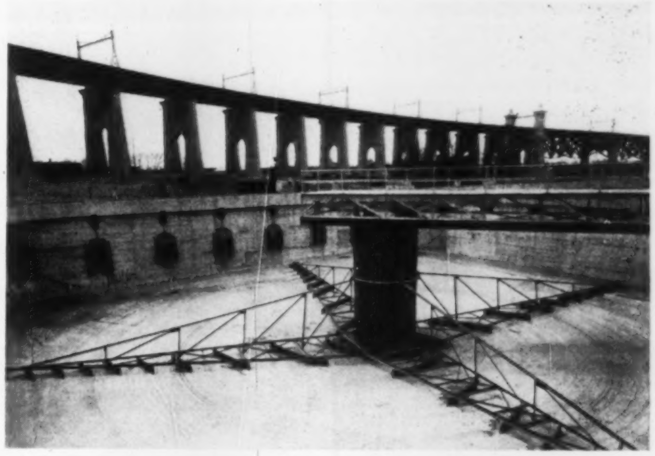
The Wards Island Sewage-Treatment Works will cost about $28,000,000, including the interceptors and tunnels. Of this amount roughly $4,500,000 is invested in the tanks which were installed on the island several years ago, while the remainder is being expended at the present time. The undertaking is divided into some forty separate construction contracts. It is expected that the plant will be in operation in 1937.

WINNING SUPPORT OF THE PUBLIC

Perhaps the greatest effort made by the department in the last two years was convincing those who control the city's finances that the time to make plans for additional treatment works is before construction of the earlier plants is started. By dint of much persuasion and by establishing a sympathetic relationship with the citizens in the particular localities concerned, the department succeeded in obtaining the funds necessary for engaging personnel for making preliminary investigations, engaging consultants if necessary, and designing two other important treatment works. The sites selected for these plants were Tallmans Island near College Point in the northern part of Queens; and Jamaica Bay. The plans for an activated sludge plant at Tallmans Island have progressed to a point where they will be ready for contract this year. Title to the land has been secured and money authorized for the construction of the first section of the works. When this plant is built it will mark another forward step.

Tallmans Island, near Flushing Bay, was selected as one of the many locations in which the construction of a single plant would be effective, as it appeared that the northern part of Queens was neglected by us, while at the same time, owing to the creation of a great park system, it might develop rapidly. We had already designed and are building a large, modern, power-producing incinerator directly at the head of Flushing Bay. The coming of the World's Fair would seem to justify the selection of this site for the construction of sewage and garbage plants, and it seems that the fair has proved to be the lever necessary to secure funds for building the sewage works.

In Jamaica Bay we have a geographical condition unique within the city limits. Here a body of water hundreds of acres in extent, ideally situated for recreational use, is so self-contained that it is not materially affected by the pollution existing outside its confines, while the pollution occurring within it is not communicated to outside waters. Obviously in such a location, and with limited tidal circulation, a high degree of treatment throughout the year is indicated. This plant will therefore also utilize the activated-sludge process. The most efficient of the department's fine-screening plants is on the site of the future treatment works. This activated-sludge plant will accordingly differ from the Wards Island Plant in that fine screens will take the place of sedimentation tanks.


Preliminary Tank, Wards Island Sewage-Treatment Works

MUCH REMAINS TO BE DONE

Those at present responsible for the conduct of the Department of Sanitation would indeed be lacking in perspective did they not acknowledge that although the story of pollution in this city has entered another phase it has not really entered its final phase. The city of New York did not get its water supply, on which more money has been spent than on the construction of the Panama Canal, in a day, and it will not get rid of pollution from sewage in a day. Perhaps two hundred million dollars additional will have to be expended, and much time will be required. There are those who criticize the spending of great sums of money on bridges, tunnels, and parks while the waters are still polluted, but one might as well be a realist and admit that the people would rather have the bridges, tunnels, and parks. There are also those who seem to think that money obtained from the federal government is toy money, and who are astonished that the whole problem is not tackled simultaneously even though it does require two hundred million dollars. They do not realize that most of it must be paid for directly and the remainder indirectly, and that the federal government merely acts as a very liberal banker.

It would not be surprising if the year 1937 were to witness the coming of the final phase of a real and concerted attempt to tackle the whole problem of pollution in a big way. To do this we believe that one hundred million dollars should be appropriated to be spent in a period of about five years.

It is more than likely that the process of education of the public, not only to wish for a clean harbor but to demand it and to be willing to pay for it, will receive a considerable impetus by the operation of the Coney Island and the Wards Island Sewage Treatment Works. In this belief we have again requested a sum of money to engage personnel to bring the work of designing a general plan, divided into increments of definitely defined treatment plants, to a rapid and positive conclusion.

Publicizing Municipal Services

A Successful Adventure in Popularizing Some Activities of the Akron Department of Public Service

By E. A. Kemmler

Member American Society of Civil Engineers
Former Director of Public Service, Akron, Ohio

A FIERCE white light of publicity beats at all times upon the activities of city departments. Through lack of adequate information, news writers at times misrepresent the objectives and achievements of service departments, directed and manned for the most part by able engineers. To provide the data essential to the right kind of publicity as well as to make available suggestions for possible improvements, Mr. Kemmler instituted a series of 93 papers or monographs, prepared individually by the heads of 12 divisions of the Akron Department of Public Service and released weekly over a period of 20 months. These monographs were well received by newspapers and periodicals. Incidentally, they also helped to bring to the attention of citizens the work of the engineer in public service—important duties which are too often submerged in favor of more sensational if less essential municipal activities.

WHAT can be done to secure the right kind of publicity for municipal services, free from the color and inaccuracy which characterize the average city hall reporter's effusions? This matter has long been a subject of speculation on the part of the writer. Here is a commodity which costs the municipality nothing. Why not turn it to some good account by improving its quality with facts and figures assembled by the division heads or managers in the municipal service? Most of these officials are engineers who are familiar with the business of the city and are capable of preparing intelligent and accurate reports on the various activities for which they are responsible.

Many years' experience in the employ of the public has taught me that newspaper reporters and editors are normal human beings like the rest of us, who have legitimate aims in life and who usually welcome constructive assistance from public officials in sifting out and preparing news items which may be of interest to the public. The reporter is paid for furnishing a certain amount of "copy" for his paper. In order to hold his job, he will produce it, from one source or another, whether we like it or not. It may be good or bad, depending upon the manner in which it is obtained, and the amount of material added by the more or less fertile imagination of the reporter himself. If, therefore, the product can be improved by a little "home work" on the part of the makers of municipal history, this may well prove a worth-while undertaking.

LAUNCHING THE PLAN

One way to determine the usefulness of an idea is to try it out, and during my term as Director of Public Service of Akron, I decided to do so. My motive in making the experiment was to provide a higher grade of publicity than we were getting. Accordingly on April 14, 1934, the following announcement was sent to the managers of the twelve divisions of the Department of Public Service:

"The Service Department will prepare, from time to time, and distribute to the heads of the several departments and divisions, members of the Council, and to others who may be interested, brief monographs presenting cogent facts on various subjects connected with the activities of the Service Department and Planning Commission. All heads of divisions and subdivisions are urged to contribute worth-while information in tabloid form, or suggestions for the improvement of the service, through the medium of these monographs, which will be numbered and multigraphed under the names of the authors."

The division managers responded eagerly to the invitation to contribute to the program, and during the succeeding twenty months until the end of 1935, no less than 93 monographs featuring various municipal activities were prepared and distributed every Monday morning without intermission. The subjects and number of monographs were as shown in Table I.

Table I. Monographs Issued by Akron Department of Public Service, 1934–1935

Subject	No. of Releases	Subject	No. of Releases
Municipal water works	12	Direct housing relief	2
Sewerage	11	Municipal buildings	1
Sewage treatment	6	Finance	5
Sludge fertilizer	1	Weed cutting	2
Street paving and maintenance	5	Permits and complaints	1
Street cleaning and rubbish collection	2	Municipal airport	5
Snow and ice removal	1	City planning	4
Street traffic	5	Parks and playgrounds	2
Federal public works	8	Street lighting	1
Grade-crossing elimination	3	Street signs	1
Garbage collection and disposal	3	City surveys	1
		Miscellaneous subjects	11
		Total	93

Bright and early each Monday morning the news writers came in to claim their copies. The mailing list included the Akron chamber of commerce, local industrial engineers, schools and libraries, engineering periodicals, out-of-town reference libraries, and numerous individuals who saw reprints in the periodicals, where many were published in full. Requests still come in, although the service was discontinued in January 1936.

Generous space was allotted to the monographs by the local newspapers, and many favorable comments were received from local business men, as well as from engineering societies and publishers in other localities.

It is rather difficult for the promoter of such an adventure in publicity to correctly evaluate the benefits accruing to the public or to the contributors, or both, from the undertaking. However the following observations can at least be made:

The newspapers were glad to receive these "state papers." One editorial writer confided that he would be lost without his monograph in the Monday mail.

The department was immune from petty newspaper criticism throughout the duration of the program, and the stock of the engineers who participated rose perceptibly. Writing the monographs was good practice and great fun for the engineers and it is my belief that they, including the writer, derived the greatest benefit from the undertaking.

Since the activities described in the monographs are recurring constantly, the bound volume of papers constitutes an excellent reference book for succeeding administrators as well as for the newspaper men who have preserved their copies. The average member of the city council, who might have profited to a great extent, gained nothing, because he either could not or would not read the monographs.

In my opinion the experience was successful and well worth the effort. The material at our disposal had by no means been exhausted and the publications could have been continued indefinitely. The new administration which assumed control in January 1936 discontinued the program, however, for the reason that the PWA program of improvements became so heavy that there was no time left for literary work. However, in my opinion the monographs have only been suspended to be revived in a bigger way as soon as the time is ripe.

Bolting 81-In. Diameter Liner-Plate Sections for Sewer, East Market Street, Akron

A TYPICAL MONOGRAPH

The following Monograph No. 53, entitled "O.P.M.," prepared by the writer and released under date of March 25, 1935, is appended to illustrate the general character of these papers:

"Political as well as business corporations operate, to a large extent, with O.P.M. (Other People's Money). It is often stated as a truism (not to be disputed) that if private corporations were managed as badly as our cities or states, they would all land in the bankruptcy court. Maybe so; and then again, maybe the reverse is true. I make the bold statement that if cities were managed as badly as many private corporations, the Sumner-Wilcox bankruptcy law would be worked overtime.

"The acts of public officials and employees are subject to merciless publicity, which is probably a good thing, while the affairs of business are conducted more or less secretly, which may also be a very good thing; in either case the stockholder or taxpayer has very little to say as to how his money shall be spent after he has parted with it.

"The existing administration of the City of Akron is operating on the theory that O.P.M. should be spent to secure the greatest good for the greatest number and that thrift is as essential in public as in private affairs.

"Time was, not so long ago, when the measure of a public official's greatness was the amount of money that he managed to spend for services and improvements; 'them wuz the happy days,' but the great spenders of those days have reformed and the proverbial Scotchman is a spendthrift compared with these lads, who are now on the outside looking in and have learned that it makes all the difference in the world as to whose ox is being gored.

"During the halcyon days, when municipal bond issues could be floated with reckless abandon, the construction program of the Highway, Sewerage, and Water Works divisions was as much as $5,000,000 per year, and operating expenses of the Service Department another million and a half (including street repair). The council and administration put on a show called 'big-town stuff' with great gusto, continuing even after the operating budget could no longer be balanced with tax money. At the present time, the entire operating and improvement program of this department totals less than one million. And yet we could probably get along if let alone.

"A few examples of how O.P.M. should not be spent, without very careful consideration, would be in order:

"(*a*) A pioneer homebuilder acquires a lot at the extreme end of an ungraded street for the sole reason that it is cheap, builds the first cottage on the street and then demands a graded and cindered road for his individual benefit, at the expense of the community. Such cases are not unusual.

"(*b*) Another pioneer has a home in a section that cannot normally be developed for many years, because the city unwisely annexed the territory without improvements, at a time when it was without resources to develop it. He insists that, as a taxpayer, he is entitled to water and sewer immediately, even though it might bankrupt the city to provide such facilities. The time for home owners thus situated to talk was when the question of annexation, engineered by selfish interests in and out of the council, was up for discusson, and to protest against it.

"(*c*) Creating jobs for the sole purpose of paying political or private debts, or for press-agenting the administration. No such jobs were created by this administration, but a number of fat ones, inherited from previous administrations, were scrapped in January 1934.

"A legislative body can spend more in a one-day session than the administration can save in ten years; it is not so much the council which is to blame, as the system; the situation of the councilman, legislator, or congressman is different from that of the administrator, in that he is compelled to serve two masters. As the representative of a limited constituency, he is expected to raid the common treasury for all possible benefits for his district, while as an employee of the city, state, or nation, from which source he receives his salary, he must, like Pooh-bah, 'see that strict economy is observed.' Can he serve both masters with equal fidelity?

"This department, including the water works, now handles about $2,300,000 of O.P.M. annually. The department's conception of its responsibility is that the money is provided to purchase honest goods and services at current market prices. Its creed can be stated in a few short sentences.

"1. O.P.M. is just as hard to earn as our own.

"2. Expenditures in all divisions must be kept within the appropriation.

"3. Expense accounts charged to O.P.M. should be no higher than if paid with our own money.

"4. Publicly owned equipment should be used for public business exclusively.

"5. Politics is a commendable pastime—if practiced on our own time and at our own expense.

"6. The Service Department recognizes no special privilege, particularly in the expenditure of O.P.M.

"7. Unnecessary help has been eliminated; but no important work will be undertaken until the necessary machinery and funds have been provided."

Constructing the Caledonian Canal

And Other Canal Work of Thomas Telford Subsequent to the Year 1800

By JOHN F. BAKER, ASSOC. M. AM. SOC. C.E.
and JOHN ARMITAGE
RESPECTIVELY PROFESSOR OF CIVIL ENGINEERING, UNIVERSITY OF BRISTOL, BRISTOL, ENGLAND,
AND EDITOR, "SQUASH RACKETS AND FIVES," LONDON

HIS engineering reputation established about 1800 by successful work on the Ellesmere Canal, connecting the valleys of the Mersey and Severn rivers, Telford next turned his genius to construction of the Caledonian Canal. This 200-mile watercourse, extending clear across Scotland from the North Sea to the Atlantic, includes 22 miles of artificial channel. The cross section is trapezoidal, being 50 ft wide at the bottom, 120 ft at the surface, and 20 ft deep. As the entire work had to be done by manual labor, it is not surprising that the undertaking required 20 years for completion. Telford later designed and constructed a new $2\frac{1}{2}$-mile tunnel through Harecastle Hill to carry the Trent and Mersey Canal, and 65 miles of the Gotha Canal in Sweden. While these activities form a complete story, readers may wish to refer to the authors' paper on Telford's early works, published in the November 1936 issue.

IN 1801, Thomas Telford, then 44 years of age, was appointed by the government to make a survey of Scotland, and to report on the improvements which he considered necessary to develop that very barren country. This task, which was part of the government scheme to relieve the unemployment resulting from the changing conditions of farming in the north, imposed considerable responsibility upon Telford. For some time the Highland landlord and the farmer had found it more profitable to farm sheep in place of black cattle, for sheep required less labor, and there was a good market for wool. This change meant that many men lost their employment through lack of work while others were replaced by laborers from the south of Scotland, who had more and better experience with sheep.

One immediate result of the unemployment was emigration to America. Viewing this situation, the government decided to take immediate action to provide new employment and, at the same time, improve the communication system of a country which lagged far behind the rest of the British Isles in this respect. The idea, as Telford saw it, was that the inhabitants of Scotland, who were so "strongly attached to their native country," would "greedily embrace this opportunity of being enabled to remain in it."

One of the improvements recommended by Telford and afterwards carried out was the construction of a canal across the face of Scotland from the North Sea to the Atlantic. Scotland, it will be remembered, is strikingly divided into two parts by an almost straight line of lochs, running from Inverness in the east to Fort William in the west (Fig. 1). Telford was not the first whose imagination was fired by the engineering possibilities of this valley. As early as 1773 the famous James Watt had examined the same ground and had reported that it would be practicable to connect loch to loch, and the lochs to the seas by a series of navigable canals. But economic conditions were not favorable at that time, and the matter got no further than the report.

Thus before Telford could begin work on the project he had to convince the government commissioners not only of the practicability of such an undertaking but also of its economic worth. First and foremost, he argued, it would solve the problem of unemployment. Such a project, at a time when there was no mechanical excavating equipment, would have to be carried out entirely by hand and would thus employ large numbers of men. It was also claimed that should the canal be capable of taking sea-going vessels, the fisheries would benefit by an easy means of transferring the men skilled in cod and ling fishing from the west coast to the east. Telford further pointed out that the absence of a naval station in Scottish waters left British shipping passing around the Orkneys at the mercy of marauding Frenchmen, and he suggested that such a canal would save much time for ships wishing to sail from Scandinavia or the east coast to the west coast, or to Ireland.

The evidence of "respectable shipmasters" showed conclusively that the trip around the north of Scotland occupied a fortnight. It was estimated that, by means of the proposed canal, it would be possible to cross the country regularly in five days with a moderate fair wind, and in a maximum of 12 days if the wind were contrary. There was no doubt that the canal would save time, and well-informed persons from Dublin, Liverpool, Greenock, Leith, Aberdeen, and Peterhead all agreed on the danger to life and property to be encountered in sailing around the north coast.

There was still another argument in favor of the project. Much Baltic timber was used in England at the time. By carrying it through the canal instead of around the coast, it was estimated that a saving of from 8 to 10 per cent would be possible. At that time the price of timber on the west coast of England and in Ireland was about 10 per cent more than on the east coast, due to the cost and risk of carrying it around the Orkneys. For the moment this argument served its purpose. Soon, however, political influences were to lose the timber trade for the Caledonian Canal, and to make it, even before it was completed, little more than the white elephant it is today. During the period that the canal was under construction, European wars then raging interfered with commerce to and from the Baltic, and the British Government allowed Canadian timber to be imported duty free. When peace came in 1815, those who had invested capital in Canada urged the government to continue the prohibitive tax on Baltic timber which had raised its price enormously and practically destroyed the trade.

Telford's preliminary estimate of the cost of construction made the canal attractive to the commissioners. He considered that the total cost, excluding the purchase of land (which would be cheap except for the district around Inverness), would be not more than £350,000. The commissioners consulted two additional engineers, whose estimates were £478,500 and between £600,000 and £700,000, respectively. But as neither of them had surveyed the ground, Telford's estimate was ac-

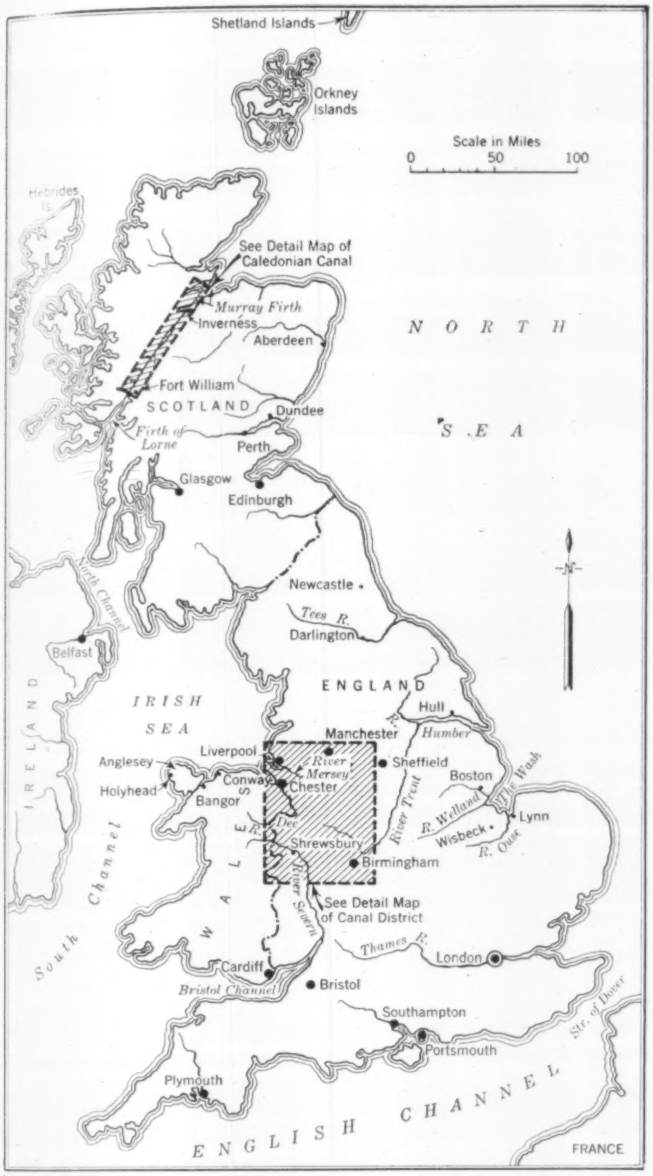

Shetland Islands
Orkney Islands
Scale in Miles
0
50
100
Hebrides Is.
See Detail Map of Caledonian Canal
Murray Firth
Inverness
Aberdeen
N O R T H
S E A
Fort William
SCOTLAND
Dundee
Firth of Lorne
Perth
Glasgow
Edinburgh
N
Newcastle
North Channel
Tees R.
Darlington
Belfast
IRELAND
IRISH SEA
ENGLAND
Hull
Humber
R.
Manchester
Liverpool
River Mersey
Sheffield
Anglesey
Conway
Chester
Holyhead
Bangor
Boston
The Wash
R. Welland
Lynn
River Trent
Wisbeck
R. Ouse
Dee R.
Shrewsbury
WALES
Birmingham
River Severn
See Detail Map of Canal District
South Channel
Thames R.
London
Cardiff
Bristol Channel
Bristol
Southampton
Str. of Dover
Portsmouth
Plymouth
ENGLISH CHANNEL
FRANCE

Fig. 1. Map of Great Britain, Showing Location of Thomas Telford's Principal Works

cepted. The final cost, however, excluding the cost of the land, management, and similar factors, was £720,600, or more than twice the sum which decided the commissioners to undertake the construction. Such a condition is not unheard of today, and Telford's explanation that the main increase was due to higher labor charges following the war is not invalid.

EXCAVATING A CANAL BY HAND

The length of the Caledonian Canal—200 miles from coast to coast—is not its outstanding feature, for of this length, nearly 180 miles are navigable lochs (Fig. 2). It is its width that is remarkable. It must be remembered that the sole excuse for the canal was its capacity to present an inland coast-to-coast route for sea-going vessels. To provide for such vessels, the channel was made 50 ft wide at the bottom, 120 ft at the surface, and 20 ft deep. The digging by hand of such a trench, 22 miles long, was no small task, and it is hardly surprising that the full length of the canal was not open to navigation for 20 years.

Obviously the locks had to be of immense size. At the western end of the canal, it was found necessary to place the sea lock at Corpach, through which entry would be made, at a distance of about 100 yd below the high-water mark. This construction presented several difficulties not usually encountered in canal work. Two earth mounds, faced with masonry, were accordingly pushed out from the shore to the point where Telford had decided the entrance to the lock should be. Between these mounds, and covering the site of the lock, Telford sank a box cofferdam which was kept in position by timber piles driven through 8 ft of gravel into the rock beneath. It was considered essential that the piles holding the cofferdam should not only be driven through the gravel but should also have their points firmly fixed in the rock. The usual method of driving by hammer blows was thus out of the question.

Telford's method of solving this problem is interesting. The work was being done at a place where there was a depth of 3 ft of water, beneath which lay more than 8 ft of silt and gravel before rock could be reached. First Telford built a wooden tube 3 in. thick, with an internal diameter of 22 in. At intervals this was strengthened with iron bands, and at the bottom end it was shod with an iron rim. Near the top, rings were attached so that it could be raised or lowered with ease. The tube was then allowed to sink in a vertical position just over the spot where the pile was to stand. When its shoe touched bottom, the top of the tube was plugged with a block of timber 2 ft long and strengthened with iron hoops. The tube was then driven into the gravel bed, just as a pile would be driven, by repeated blows from a 1,000-lb weight dropping from a height of 30 ft on top of the timber plug. The tube sank easily into the gravel for a depth of $3^1/_2$ ft, but would go no further. An auger was now constructed, with a blade fashioned in the shape of a quadrant of a circle having the same radius as the inside of the tube. Below the blade were four flat teeth, inclining downwards, which were used to loosen the gravel. The shaft of the auger was long enough to reach the top of the tube when the blade was in contact with the gravel at the bottom. Cross handles were attached to the end of the shaft, and by this means the auger was turned. When the blade of the auger was full it was lifted out. In this laborious way, $3^1/_2$ ft of gravel was removed.

Driving was then recommenced, and by alternately driving and removing the gravel, the tube eventually reached the face of the rock. To clean the rock of gravel, an iron pipe 3 in. square was sunk inside the tube. The gravel was then pumped up through the pipe by means of a length of iron tubing 3 in. in diameter, with a one-way flap valve at the lower end. After the gravel had been cleared from the rock, a tool was passed down the square pipe and worked from above until a hole $2^1/_2$ in. in diameter and 20 in. deep had been bored.

Later an iron dowel, 2 in. square, was driven into the hole in the rock, and the point of the pile was fashioned to receive it. Next, the pile, fitted with guides to ensure true centering, was dropped down the 22-in. diameter wooden tube, and a blow on its upper end fastened it tightly to the dowel. Finally, the wooden tube was drawn up, and the pile was in place. This description of a single task illustrates one of the many problems that the engineer of Telford's day had to face in preparing the ground for the work to come.

A STAIRWAY OF WATER

The locks of the Caledonian Canal were either 170 or 180 ft long and 40 ft wide, with a rise of 8 ft. In places where the canal had to be lifted through a height of more than 8 ft, Telford constructed a line of connected locks, one opening into another. The greatest of these works was only a mile from Corpach, where eight connected locks lifted the canal through 64 ft in a distance of 500 yd. From here the full canal section, of dimensions previously noted, led into Loch Lochy.

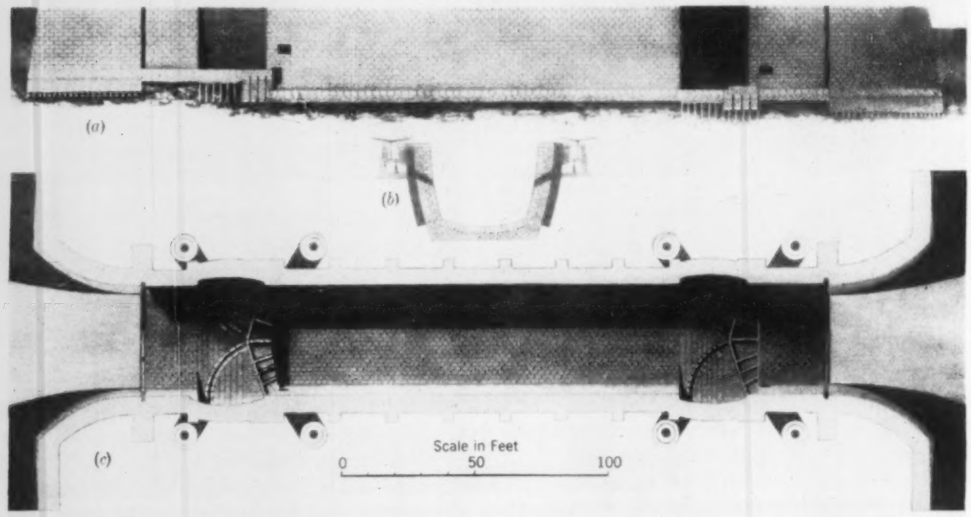

(a)
(b)
(c)
Scale in Feet
0
50
100

FIG. 3. SEA LOCK ON THE CALEDONIAN CANAL AT CLACHNACARRY
Length of Lock 180 Ft; Height 21 Ft, 6 In.; Thickness of Wall 6 Ft; Length of Bearing Piles, 8 Ft. (*a*) Longitudinal Section Through Lock, (*b*) Cross-Section, (*c*) Plan

At the eastern end of Loch Lochy the surface of the ground was 20 ft above the canal water level for the two miles to Loch Oich. This meant that excavation was necessary for a depth of 20 ft on a width of 120 ft in addition to the canal section. As Loch Oich was the highest part of the canal, an abundant water supply for the whole system was here derived from the River Garry, which drains Glengarry. Eastward of Loch Oich, another great group of five connected lochs carried the waterway down 40 ft to the level of Loch Ness, supplying 22 miles of easily navigable water, which in no place is less than a mile wide. For the remainder of the distance to the sea, the canal ran near the River Ness and, at three particular points, Telford was obliged to erect great embankments to separate one from the other. The last important change of level, which was accomplished by the construction of four connected locks, was at Muirtown, where the canal was carried into a great basin 32 acres in extent. This basin was equipped with a wharf and a warehouse, with connection to the sea through a tide lock at Clachnacarry (Fig. 3).

The construction of this lock presented difficulties as formidable as those encountered at Corpach, but quite different, so that the experience he had gained proved of little value to Telford. At Clachnacarry he made tests which showed nothing but mud for a depth of 58 ft.

He decided not to attempt to excavate to sound bearing with the help of a cofferdam, but instead to consolidate the mud until it was capable of carrying the required load. As at Corpach, two earthen banks, later to contain the canal, were built out from the shore, and when

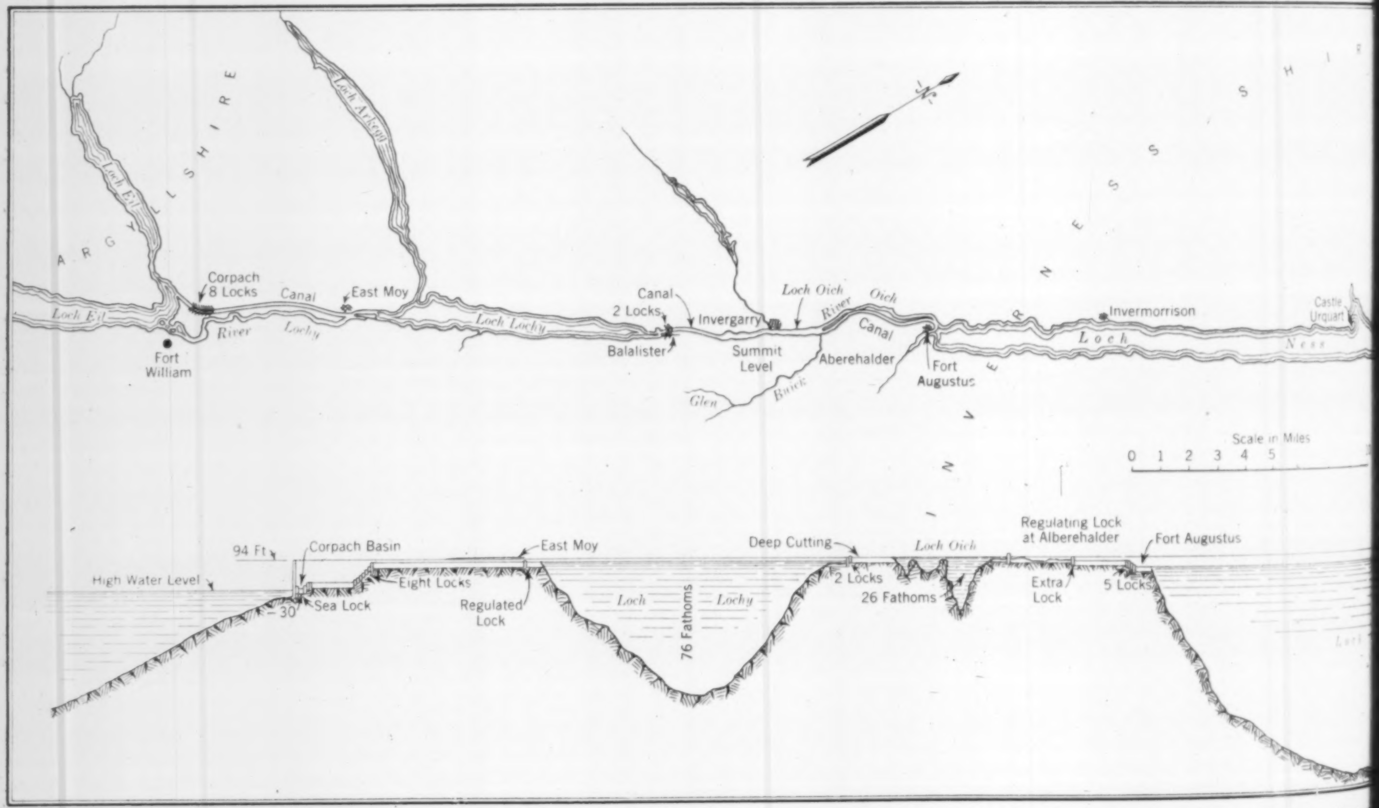
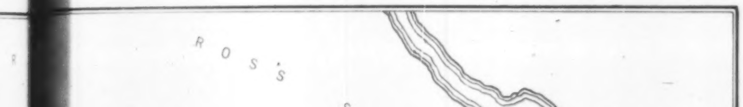

ARGYLLSHIRE
INVERNESS SHI
Loch Eil
Loch Eil
Loch Arkaig
Corpach
8 Locks
Canal
East Moy
River
Lochy
Fort
William
Loch Lochy
Canal
2 Locks
Invergarry
Balalister
Summit
Level
Loch Oich
River
Oich
Canal
Aberehalder
Glen
Buick
Fort
Augustus
Invermorrison
Loch
Ness
Castle
Urquart
Scale in Miles
0 1 2 3 4 5
94 Ft
Corpach Basin
High Water Level
30
Sea Lock
Eight Locks
East Moy
Regulated
Lock
Loch
Lochy
76 Fathoms
Deep Cutting
2 Locks
Loch Oich
26 Fathoms
Regulating Lock
at Alberehalder
Extra
Lock
Fort Augustus
5 Locks

FIG. 2. SKETCH MAP AND SCHEMATIC ELEVATION OF THE CALEDONIAN CANAL IN NORTHERN SCOTLAND. THE TOTAL LENG

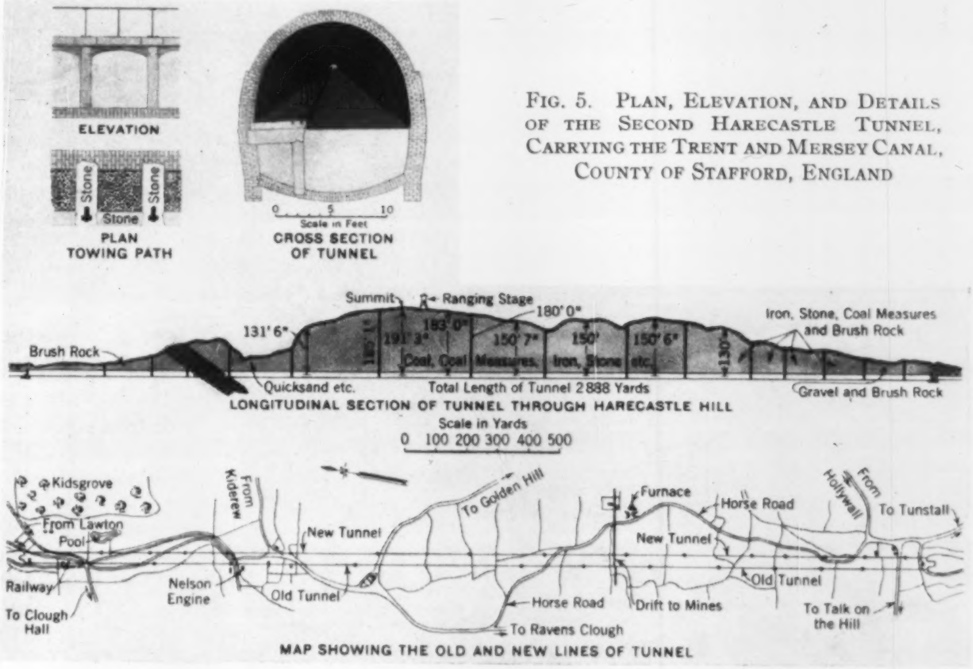
they had reached the site of the lock, the space between them was filled with clay. On top of this clay, which covered a much greater area than that to be occupied by the lock, Telford deposited a mass of stone heavier than the load which was ultimately to be carried. Under this pressure the clay sank, compressing the mud beneath. After a period of six months, when all movement had ceased, it had sunk 11 ft into the mud.

The stones were then removed, and excavation for the lock began. When the mud was reached it was found to be well knit and firm; and in spite of the fact that the foundations were carried down a distance of 8 ft, only a small quantity of water filtered through, and the masonry of the lock was built successfully. By means of such inventions, as well as by the "judicious arrangement and steady perseverance" to which Telford refers, the Caledonian Canal was completed in 20 years. Unhappily it has failed to bring those economic advantages for which it was intended, but it remains a monument to its constructor. Telford's reputation was now everywhere established, and wherever a canal was contemplated, he was in demand. One or two other projects of this kind deserve special mention.

In 1804 he built a short length of canal between Glasgow and Paisley, and in 1807 he began a long series of works for Cheshire (Fig. 4) by constructing $3^1/_2$ miles of canal between Frodsham Point and the Mersey near Runcorn. He also carried out other works in connection with the navigation of the River Weaver.


R O S S ' S
S H I R E
Firth of Cromarty
Loch Beauly
Clachnacarry
Muirtown
Canal
Lock
Bona Ferry
Inverness
Murray
Firth
Bona Ferry
Muirtown
94 Ft
High Water Level
Regulating Lock
4 Locks
Sea Lock
Clachnacarry
30
Loch Beauly

Miles. Artificial Channels Occupy 22 Miles


Stone
Stone
Stone
0 5 10
Scale in Feet
Summit
Ranging Stage
180' 0"
131' 6"
183' 0"
185' 1"
191' 3"
150' 7"
150'
150' 6"
130'
Iron, Stone, Coal Measures and Brush Rock
Brush Rock
Coal, Coal Measures, Iron, Stone etc.
Quicksand etc.
Total Length of Tunnel 2888 Yards
Gravel and Brush Rock
Scale in Yards
0 100 200 300 400 500
Kidsgrove
From Lawton Pool
Railway
To Clough Hall
From Kiderew
New Tunnel
Nelson Engine
Old Tunnel
To Golden Hill
Horse Road
To Ravens Clough
Furnace
Drift to Mines
Horse Road
New Tunnel
Old Tunnel
From Hollywall
To Tunstall
To Talk on the Hill

ELEVATION

PLAN TOWING PATH

CROSS SECTION OF TUNNEL

LONGITUDINAL SECTION OF TUNNEL THROUGH HARECASTLE HILL

MAP SHOWING THE OLD AND NEW LINES OF TUNNEL

Fig. 5. Plan, Elevation, and Details of the Second Harecastle Tunnel, Carrying the Trent and Mersey Canal, County of Stafford, England

On a neighboring waterway—the Trent and Mersey Canal—James Brindley some years earlier had found it necessary to construct a tunnel through Harecastle Hill for a distance of 2,888 yd. At its largest section this tunnel was only 12 ft high and 9 ft wide, so that a barge 7 ft wide, moderately loaded, could scarcely pass through. The operation of thrusting a boat through this tunnel was done by men called "leggers," who lay on their backs on the top of the barge and pushed against the roof and sides with their feet.

As trade increased, the delay and inconvenience of this method became intolerable. Early in 1822, therefore, the canal company asked Telford to examine Harecastle Hill and report upon the practicability of making a second tunnel. His report was favorable, and in July 1824, he was authorized to start work.

TUNNELING HARECASTLE HILL PRESENTS DIFFICULT PROBLEMS

Fifteen shafts were sunk along the line of the tunnel for speed, the deepest being 179 ft (Fig. 5). The tunnel was driven simultaneously between shafts. On February 21, 1825, the first brick of the tunnel lining was laid, and so successfully did the work progress that the entire lining was in place on November 25, 1826. The towing-path was completed and the passage opened not quite three years after the work was begun.

The cross-section was 16 ft high by 14 ft wide, 4 ft 9 in. being covered by the towing-path, which was supported on pillars. The tunnel is so straight that its whole length of 2,926 yd is visible from a single viewpoint. The workmanship was excellent; for years the joints between the brickwork were scarcely discernible, although work had been carried on in several places at the same time through soil of varying composition.

In 1825 Telford began another canal, 29 miles long. This was brought into being by the new silk industry, which trebled the population of Macclesfield between the years 1801 and 1831. A more important work, although shorter in point of distance, was carried out by Telford for the Birmingham Canal Company. As early as 1783, the famous engineer Brindley had built some 70 miles of waterway near Birmingham. Following the dictates of economy, cuts and fills had been avoided as far as possible, with the result that the canal twisted and turned on its way across country.

Reporting upon it in 1824, Telford proposed that a new canal should be built, extending in a nearly straight line between Birmingham and Autherley, and cutting the length of the journey from 22 to 14 miles. This could be done at almost one level by making a 70-ft cut through the summit of the system at Smethwick. Telford's recommendation received the support of James Watt, whose improved steam engine had been patented, and who had his engine works close to the canal. The canal company agreed to Telford's proposal, and the waterway was constructed. The canal was 40 ft wide and had a towing path on each side, an unusual arrangement which allowed traffic to pass unimpeded in both directions.

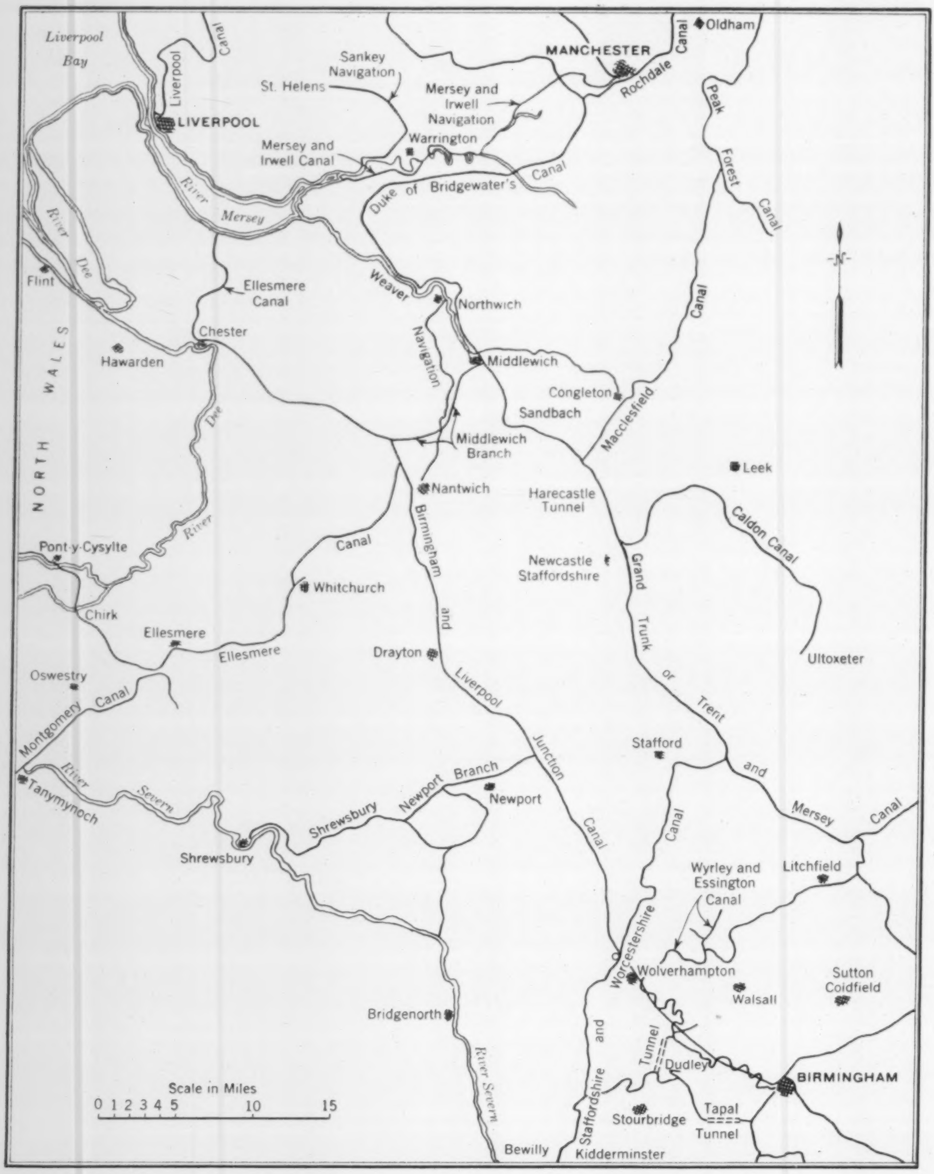

Liverpool Bay
Liverpool Canal
LIVERPOOL
Sankey Navigation
St. Helens
MANCHESTER
Oldham
Rochdale Canal
Mersey and Irwell Navigation
Warrington
Mersey and Irwell Canal
Duke of Bridgewater's Canal
River Mersey
Peak Forest Canal
River Dee
Flint
Ellesmere Canal
Weaver
Northwich
Chester
Hawarden
NORTH WALES
Navigation
Middlewich
Congleton
Sandbach
Macclesfield
Canal
-N-
Middlewich Branch
Nantwich
Harecastle Tunnel
Leek
Caldon Canal
River Dee
Pont-y-Cysylte
Canal
Whitchurch
Birmingham and Liverpool Junction Canal
Newcastle Staffordshire
Grand Trunk or Trent and Mersey Canal
Chirk
Ellesmere
Ellesmere
Drayton
Ultoxeter
Oswestry
Montgomery Canal
Stafford
River Severn
Tanymynoch
Shrewsbury Newport Branch
Newport
Shrewsbury
Wyrley and Essington Canal
Litchfield
Worcestershire Canal
Wolverhampton
Walsall
Sutton Coldfield
Bridgenorth
Staffordshire and
Tunnel
Dudley
BIRMINGHAM
Scale in Miles
0 1 2 3 4 5 10 15
River Severn
Stourbridge
Tapal Tunnel
Bewilly
Kidderminster

FIG. 4. SKETCH MAP OF CANALS IN THE DISTRICT BETWEEN LIVERPOOL, MANCHESTER, AND BIRMINGHAM, ENGLAND

Several cast-iron bridges and aqueducts of considerable size were built on the Birmingham Canal. One bridge had a span of 150 ft, the unusual length being due to the difficulty of finding suitable foundations for the abutments close to the canal. This bridge is in many ways typical of Telford's work. The design is pleasing; a long span makes the proportion of masonry small and gives an appearance of lightness to the whole structure. The arch consists of six cast-iron ribs braced together by horizontal plates and by diagonal members. The roadway, made up of plates with flanges at their edges, rests on long stringers, supported from the arch by a system of well-proportioned lattice members.

Although the cast-iron aqueducts on this canal do not compare in span with those used in the Pont-y-Cysylte aqueduct carrying the Ellesmere Canal, their design is interesting. The waterway was carried in a rectangular cast-iron trough, itself supported by a plated iron arch having a rise of 4 ft in a span of 30 ft.

BUILDING THE GOTHA CANAL

In 1808, Telford was called to Sweden as consulting engineer on the construction of a canal similar in many ways to the Caledonian Canal. Count Platen, director of a company owning a canal which connected Lake Vaner with Gothenburg on the west coast of Sweden, conceived the idea of continuing the waterway to the Baltic by uniting a number of great lakes. In this way Sweden hoped to gain an outlet to the coast for her product—timber, iron, and limestone—as well as a route of considerable importance in time of war, for it would avoid the narrow channels between the Danish Islands. Telford spent an arduous two months surveying the land and drawing up his detailed report.

The work, following his plan, was started in 1810. The total length of waterway was 120 miles, 55 of which were through existing canals. The artificial canal was of smaller cross-section than that of the Caledonian Canal, being 42 ft wide at the bottom and 10 ft deep. In all there were 56 locks, lifting vessels 162 ft from Lake Vaner to the summit and down 307 ft to the Baltic. Each lock was 120 ft long and 24 ft wide. In 1813 Telford again visited Sweden to inspect the excavations so far made and to take with him British foremen builders to supervise and instruct the Swedish workman. When the system, known as the Gotha Canal, was finally completed and opened to traffic, the King of Sweden conferred on Telford an honor equivalent to knighthood in his own country.

Speed Versus Safety on Straightaways

Skidding and Braking Tests Demonstrate Hazards of High Speeds Even Straight Ahead

By R. A. Moyer
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Does driving a car at high speed necessarily involve hazards not encountered at more moderate rates? While most drivers will probably answer this question in the affirmative, surprisingly few data have heretofore been obtained on the actual behavior of highway vehicles in motion. By means of a five-year series of investigations, however, Professor Moyer has made available basic information for determining the uniform speed-control standards which are so much needed today. The results of these studies have already been presented in detail in Bulletin 120 of the Iowa Engineering Experiment Station. The following article, dealing with the skidding characteristics of tires on different road surfaces under varying weather conditions, and the relation of the condition and use of brakes to skidding, represents the first part of Professor Moyer's summary, as presented on July 1, 1936, at the Highway Safety Conference in Ames, Iowa.

Probably no phase of highway safety gives rise to so much difference of opinion and so much confused thinking as does the question of what are the hazards created by speed and what the speed restrictions which should be placed on drivers. The statement is frequently made by engineers and traffic experts that speed per se is not hazardous and that as soon as cars are built to provide dependable operation at speeds of 80 to 100 miles an hour, the public will insist that roads be built which will permit safe operation at such speeds.

Now it is evident that if the motor car is to achieve its greatest utility in the future, actual speeds should approach very nearly the maximum dependable speeds at which the cars can be operated. However, if the hazards created as the result of a given increase in speed are so great as to threaten the utility of the car at that speed, then definite speed restrictions should be placed on the car, and the car and the road should be designed in general to provide the greatest possible safety and economy in operation at that speed.

During the past five years the writer has conducted a series of investigations which have provided considerable information concerning the hazards created by operating at high rates of speed. Included in the present article are discussions of the skidding characteristics of tires on wet, dry, muddy, snowy, and icy road surfaces, and the relation of condition and use of brakes to skidding. A discussion of skidding on curves and the effect of uneven surfaces on control will be reserved for a later article.

Highway accident statistics, as reported by police departments, state motor-vehicle departments, and insurance companies, indicate that skidding accidents constitute about 5 per cent of all highway accidents. While this appears to be a small percentage, its importance is indicated by the fact that 1,260 people were killed and 31,330 injured in the United States in 1935 as a result of skidding accidents. Skidding also contributes to accidents reported under other headings, although there is no way of telling in just what percentage of accidents it was a contributory cause. Generally the driver has some warning when an accident is impending. He is very likely to slam on his brakes, make a sharp turn, and trust to luck that by doing this he can avert the accident. If the frictional requirements of the road, the tires, or the brakes are not adequate to carry out these operations, a collision may occur or the driver may lose control of the car.

The importance of skidding as a contributing factor is therefore considerably greater than is indicated by the usual accident reports. In a special investigation on this point, carried out by Erwin, Wasey and Company, Inc., of New York City, in 1934, it was found that in 24 per cent of the accidents reported in the state of Connecticut in 1933, skidding was a contributing factor. This investigation and an analysis of accidents in Iowa further revealed that 82 per cent of all skidding accidents occurred in the four winter months when wet, snow-covered, and ice-covered roads are most common.

VARIATIONS IN SLIPPERINESS OF DIFFERENT SURFACES WHEN WET

Probably the most important part of our testing program was determining the variations in slipperiness of 30 different road surfaces in the wet condition. This is the most hazardous condition attributable to the type of materials and the methods used in constructing the

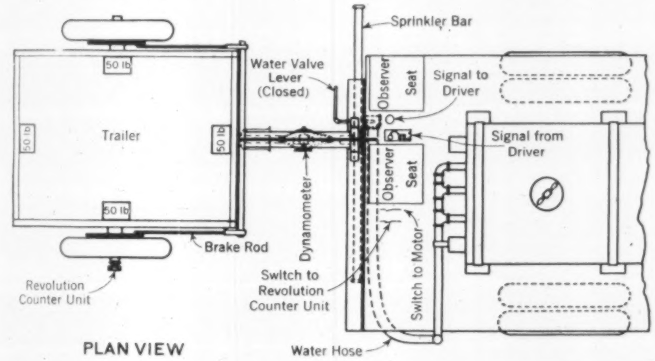
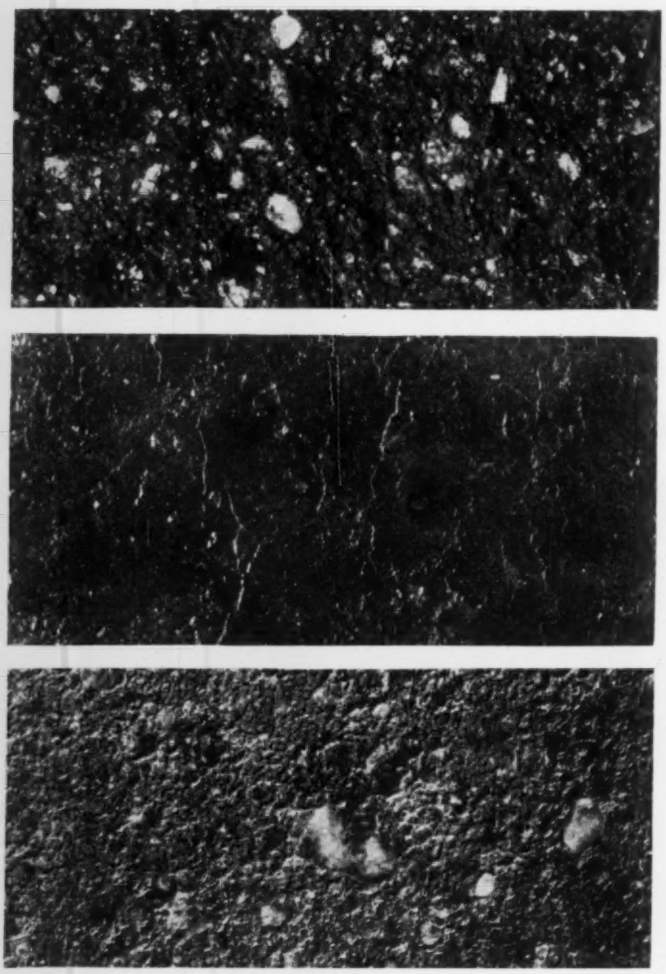


Fig. 1. Arrangement of Equipment for Determining Coefficient of Friction When Tires Are Skidding Straight Ahead



MICROPHOTOGRAPH OF "BLACK-TOP" ROAD SURFACES
(*a*) Asphaltic Concrete with Sheet Asphalt Top, A-3, Showing Typical Sandpaper Texture; (*b*) Oiled Gravel A-7, Showing Glazed Condition Due to Excess Asphalt; (*c*) Oiled Gravel A-7, Showing Exposed Aggregate on Typical Surface

road. Although surfaces covered with mud, snow, or ice are far more slippery than the same surfaces when wet, such slipperiness cannot, of course, be attributed to the material used in the construction of the road.

In discussing these tests, the term "coefficient of friction" best describes the slipperiness of a surface or the skidding resistance which a surface can provide. It may be defined rather simply as the ratio between the force causing the tires to skid and the load on the tires. If the force is equal to the load, the coefficient is unity (1.0), and if the force is only two-tenths of the load, the coefficient is two-tenths (0.2). A value of 1.0, which is very nearly the maximum that can be obtained between rubber tires and road surfaces, is an indication that the road is as safe against the hazards of skidding as it is reasonably possible to make it. A value of 0.2 is definitely indicative of a slippery and hazardous surface condition.

In these tests a specially constructed trailer was towed by a high-speed truck equipped with a sprinkler system. The force, in pounds, required to cause the tires to skid was measured with an integrating type of dynamometer. The coefficients of friction for the various surfaces and surface conditions were measured by two types of skidding, one in which the tires were skidding straight ahead (Fig. 1) and the other in which they were skidding sidewise (Fig. 2). The former is encountered when braking on a slippery surface and the latter simulates the skidding effect on curves.

These tests disclosed a wide range of values for the various surfaces from a maximum of 1.0 to a minimum of 0.1. The results of one group of tests, that for smooth-tread tires skidding straight ahead on wet surfaces are shown in Fig. 3. A significant characteristic observed on all surfaces except gravel and cinders was the marked decrease in the coefficient of friction with an increase in speed. In other words, all surfaces except gravel and cinders increased in slipperiness with an increase in speed. On gravel and cinder surfaces, the coefficients remained about the same or increased slightly with an increase in speed, largely because the wheels plowed into the gravel more deeply. However, it should not be assumed that gravel surfaces are safer than other surfaces at high speeds, since the coefficients of friction for the gravel surfaces are only one-half to two-thirds as high as those obtained on dry, hard surfaces, and furthermore, there is considerable variation in the firmness with which the gravel is packed. Loose gravel pebbles act as ball bearings under the tires, causing variations in skidding resistance which make it difficult to steer.

Tests on bituminous road surfaces provided the largest variation in coefficients of friction found on any of the surfaces tested. These surfaces, popularly known as "black-top," are generally thought of as dangerously slippery when wet. The results of the tests on several bituminous surfaces substantiated this belief. However, the tests on the majority of bituminous surfaces in the wet condition provided coefficients of friction which were appreciably higher than those of any other type of road surface tested, and it can now be said without fear of contradiction that it is entirely possible to build "black-top" surfaces which are as free from the dangers of skidding as any road surface in common use today. As there are thousands of miles of highways and streets paved with "black-top," of which a certain percentage are known to be dangerously slippery when wet, this was an important result.

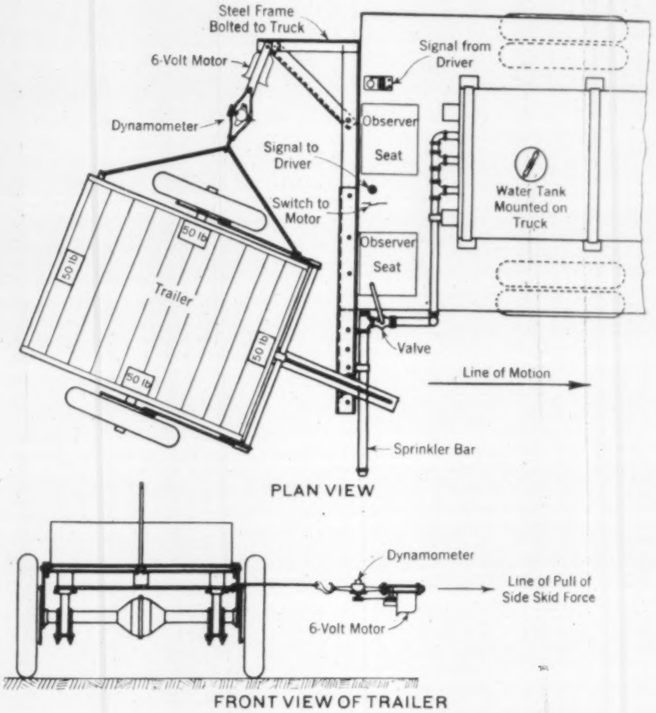


FIG. 2. ARRANGEMENT OF TEST EQUIPMENT FOR DETERMINING THE COEFFICIENT OF FRICTION WHEN TIRES ARE SKIDDING SIDEWISE ON ROAD SURFACES

An examination of those surfaces found to be slippery, revealed that they were covered with heavy seal coats of an excess of bituminous material. The surfaces which offered high resistance to skidding were covered with sharp, hard sand, or hard and finely crushed rock particles, held in place by the weaker bituminous cement. As the tops of the sand or rock particles were uncoated with bitumen, these surfaces may be said to have a sandpaper-like finish, renewable under the action of traffic and weathering.

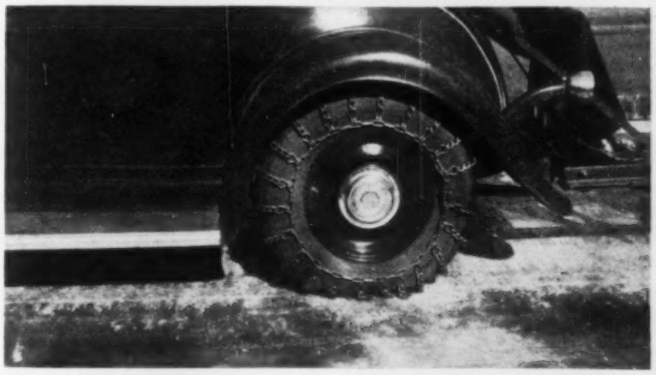
Coefficients of friction for portland cement concrete were remarkably consistent even though there was considerable variation in the surface finishes of the pavements tested. Concrete pavements have generally been considered as having a resistance to skidding when wet equal to or greater than that of any other type. Our tests indicated that this is not true, however, higher coefficients of friction having been obtained on certain bituminous types. The difference may be explained by the fact that the cementing material in concrete pavements is as hard as or harder than the aggregate, whereas in bituminous types the cementing material is relatively weak. To a certain extent, the action of traffic will wear off the grittiness or sharpness of the aggregate that remains held securely in place in the concrete, and will develop a fairly smooth-textured surface. Thus, it is not possible to maintain continuously the same sandpaper-like finish on concrete pavements as it is on bituminous types.

However, concrete surfaces, particularly those built with a broomed finish, can always be depended upon to provide a moderately high resistance against skidding, whereas bituminous surfaces may be dangerously slippery if improper methods of construction and maintenance are used. In other words, concrete roads are so uniform as far as skidding is concerned that the average driver knows what to expect, whereas "black-top" surfaces are likely to be so variable that drivers should use caution until they get the "feel" of the road.

Certain surfaces, such as wood plank, steel traffic plates, and ordinary asphalt plank, were found to be as slippery when wet as icy surfaces. These materials are generally used on bridge floors, where skidding accidents are far more dangerous because of the restricted roadway. They are so slippery that they should not be used under any conditions on our highways unless they are provided with some type of gritty surface finish.

HAZARDS DUE TO MUD, SNOW, AND ICE

The results of the tests on mud-, snow-, and ice-covered surfaces clearly indicated that they constitute the most hazardous road conditions which the motorist is likely to encounter. Ice and sleet were found to be particularly slippery, coefficients ranging from 0.05 to 0.20 having been measured. A driver venturing out on a freshly formed icy surface with a car not equipped with tire chains is inviting all kinds of trouble. The crown of the average city street introduces enough slope to cause the car to slide into the curb unless the driver can straddle the crown line. The car cannot climb a grade steeper than 3 or 4 per cent, and will slide down, completely out of control, on grades greater than 5 per cent.



The Cross-Chains on This Low-Pressure Balloon Tire Are Too Closely Spaced to Concentrate the Cutting Load

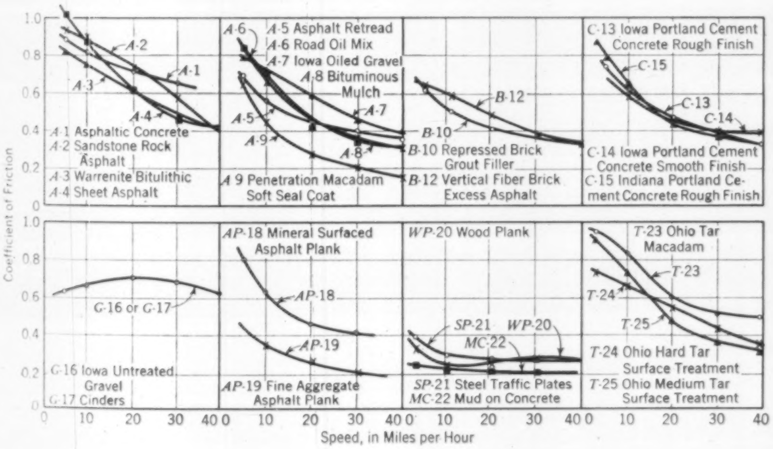


Fig. 3. Coefficients of Friction for Smooth-Tread Tires Skidding Straight Ahead on Wet Surfaces

The application of sand or cinders treated with calcium chloride over as much of the road as is practical will raise the coefficient to values higher than can ordinarily be obtained with tire chains, which drivers are slow to use, and it is well worth the cost involved. Calcium chloride will hasten the process of embedding the gritty material in the ice. The application of sand or cinders is especially desirable at intersections, on hills, and on curves, where skidding hazards are greatest. Highway maintenance men should act promptly when roads are slippery with ice or snow. By so doing they can make possible a substantial reduction in winter accidents.

The skidding characteristics of new-tread and smooth-tread tires on wet and dry road surfaces were measured at speeds ranging from 3 to 40 miles per hr. These tests were run with different types and sizes of tires, at different tire pressures and with variable loads on the tires. The tests showed conclusively that tires with treads worn smooth are more slippery on wet surfaces, at speeds greater than 15 miles per hr, than are tires with a non-skid tread. The tread design provides grooves and channels for the water as it is squeezed out between the tire and the road surface. The sharper edges of the tire also squeeze the water from the road surface at the point of contact. This squeezing and squeegee action provides a more intimate contact of the tire with the road, thus eliminating the lubricating effect of the water and the slipperiness caused by it. In the 1934 Massachusetts Highway Accident Survey, it was found that out of 80,000 vehicles observed, 38 per cent of the front tires and 26 per cent of the rear tires were worn smooth, with the fabric showing in about 3 per cent of the tires. Our tests showed that these motorists have worn away about 30 per cent of their skidding protection on wet surfaces. A large number of skidding accidents, not to mention blowouts and other tire troubles, could be avoided if motorists could be made to understand the advantages of tires with a good non-skid tread.

CONDITION AND USE OF BRAKES AN IMPORTANT FACTOR

Faulty brakes and improper use of brakes cause more skidding accidents than any other driving operation. The frictional requirement is frequently close to the maximum that the tires and road surface can provide. When this is the case either the front or rear wheels may start to skid. When the average driver discovers that his car is skidding, his first reaction is to step on the brake. But instead of correcting the skid, this makes it worse, since the frictional requirement of braking is greater than that met with in other driving operations.

TIRES USED IN THE SKID TESTS

Unequal distribution of the braking force at each wheel will seriously effect the steering of the car in emergency stops. If the brakes on the left side exert a force 40 per cent greater than those on the right side, the car may suddenly swerve over into the lane of oncoming traffic in an emergency stop, particularly at high speeds. Cars have been observed to skid end for end when stopped suddenly on dry pavements when all the braking force was delivered by one wheel and the car merely pivoted about the wheel. Braking tests on 2,134 cars indicated that variation in the distribution of the braking force is an important consideration, since 31 per cent of the cars tested had 40 per cent more braking effort on one side than on the other.

There are three improvements possible in brakes which, if perfected, would greatly improve braking action and eliminate many skidding accidents: A device to prevent any wheel from locking when the brakes are applied, especially on slippery surfaces; a device to provide stopping forces at the road surface equally balanced right and left for both front and rear wheels; and a device to give a variable braking ratio for the front- and rear-wheel brakes to compensate for the transfer of weight from the rear to the front wheels as the stopping rate is increased.

Unfortunately, the extent to which brakes can be improved for the purpose of reducing stopping distances is limited by the available friction which the road surface can provide. The average maximum coefficient which the brakes tested in 1932 could provide was about 0.5, and the average maximum rate of stopping, 16 ft per sec per sec. If the tires, road surfaces, and brakes could be improved to provide an average coefficient of 1.0, or double that available in 1932, the maximum rate of stopping could likewise be doubled, making it 32 ft per sec per sec. While such a rate of stopping would no doubt prevent many collisions, it would be rather hard on the passengers because they would have to resist being thrown out of their seats by a force equal to their own weight. On practically all dry road surfaces today, such a stopping rate is possible, and roads are rapidly being constructed to permit a high emergency stopping rate even when their surfaces are wet. Stopping distances vary approximately as the square of the speed. Thus, the stopping distance at 40 miles per hr is 4 times as great as that at 20 miles per hr; at 60 miles per hr, 9 times as great; and at 80 miles per hr, 16 times as great. Too frequently the fast driver discovers only after some unfortunate experiences that while he could stop his car in 25 ft at 20 miles per hr, it required more than 400 ft to stop it at 80 miles per hr (Fig. 4).

CONCLUSION

It is true that the American people demand high-speed travel and they will, no doubt, continue to demand higher speeds in every form of transportation. However, that is no reason why engineers and traffic officials should fail to recognize the fundamental laws of safety, and to coordinate their efforts in promoting safety. It should now be evident that the control of the car, particularly the ability to stop and steer it, depends on the amount of friction available between the tires and the road surface. This frictional requirement follows certain definite laws which are inviolate. On any given surface, the frictional forces required to stop or steer the car increase approximately as the square of the speed. The friction available, particularly on wet surfaces, decreases with an increase in speed such that the friction available at 50 miles per hr may be less than one-half of that available at 10 miles per hr. If, therefore, on any given surface, a speed is attained where the frictional requirements exceed the friction available, the safety of the car and of its passengers is jeopardized.

Operating costs in road tests up to 60 miles an hr indicate that the cost of driving a car at 60 miles an hr is about double that of 40 miles an hr and at 80 miles an hr it is probably 4 times that at 40 miles an hr. Company cars of many large corporations are now controlled by governors permitting a maximum speed of not more than 50 miles an hr. One large utility, the Dayton Power and Light Company, reports in the *Travelers' Standard* for November 1934, a reduction in operating costs of 30 per cent since this speed-control device was installed in their cars. The reduction in accidents and in time lost by accidents which should result from this speed reduction should more than repay this company for the possible saving in time theoretically obtainable by driving at high speeds.

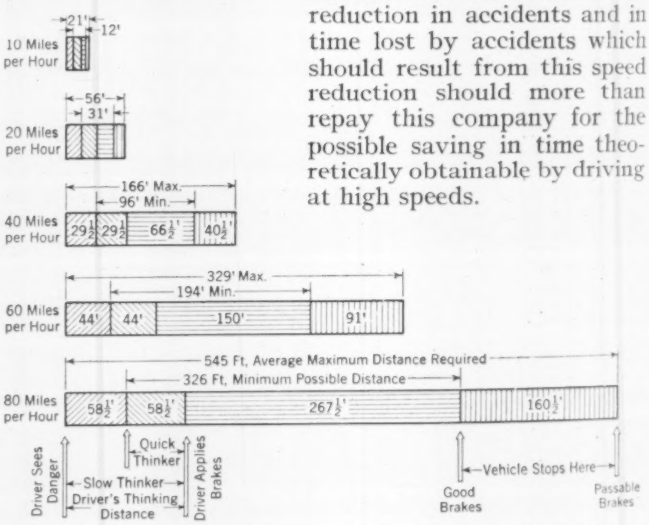


FIG. 4. SAFE SPEEDS SHOULD BE BASED ON THE AVERAGE MAXIMUM STOPPING DISTANCES
Arrangement Adapted from *Public Safety*, July 1935

Are St. Lawrence Power Estimates Too High?

Records Show That Lake and River Levels Are Steadily Falling

By THERON M. RIPLEY
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WHILE ratification of the St. Lawrence power development treaty is pending, the water levels of Lake Ontario and of the St. Lawrence River at Montreal continue slowly to fall. The question of the sufficiency of stream flow to justify the project as now contemplated is thus brought up anew, and the course of reasoning followed by Mr. Ripley would seem to give grounds for challenging the accuracy of existing official estimates of the power available. His study leads him to believe that if the project is constructed on the basis which now appears contemplated, a useful life of 50 years would be the most that could reasonably be expected. Although the article is self-contained, readers may wish to refer to the discussion by T. H. Hogg, M. Am. Soc. C.E., of the paper by Daniel W. Mead, President Am. Soc. C.E., both published in the "Transactions" of the Society, Vol. 100 (1935).

DURING 1925 and the early part of 1926, my office was in the New York State dock house located on the Erie Basin, in Buffalo, at the foot of Lake Erie and practically at the source of the Niagara River. During that time a record low-water stage was reached, in February 1926; the question of the legality of the Chicago River diversion was being brought into court; the preservation of the falls was coming to the fore; and the St. Lawrence Tidewater Association was gaining favor in the Middle West. This latter group pushed vigorously for the canalization of the St. Lawrence River to provide a navigable route for ocean-going craft up to the Great Lakes. The Association also expressed its belief that the power to be incidentally produced would enhance the value of the project.

After much argument between the various commissions and boards created by the governments of Canada and the United States, a treaty was drawn up, based on plans advocated by the Canadian engineers. It was signed in Washington on July 18, 1932, and transmitted to the Senate by the President for ratification, under date of January 19, 1933 (Executive C; 72d Congress, 2d Session). Attached to this treaty, as part of Schedule A, is the "Report of Joint Board of Engineers (Reconvened) on Improvement of the International Section of the St. Lawrence River," also the "Great Lakes–St. Lawrence Deep Waterway Treaty—Detailed Estimate of Crysler Island Two-Stage Project (Project C-217)."

I do not find, either in the treaty or in the appended schedules, any reference to primary or secondary power, the schedule mentioning only "installed capacity." In an effort to learn the basis for the assumed value of the power development, the statement by T. H. Hogg, M. Am. Soc. C.E., chief hydraulic engineer of the Hydro-Electric Power Commission of Ontario, has been taken. This is in a discussion of President Mead's paper in the TRANSACTIONS of the Society, Vol. 100 (1935), page 519. He says, "Primary power is continuous power, and therefore is limited by the winter head and flow. Secondary power is that which is available in addition to primary power during the remainder of the year." He goes on to develop power data, "expressing the output in horsepower years, based on a winter flow of 210,000 cu ft per sec (three months), and a summer flow of 235,000 cu ft per sec (nine months)."

This quotation gives a definite basis upon which to predicate power values. If the amount of water stated can be used twelve and nine months of the year, values can be secured within limits fixed by present estimates; but if water is not available in the amounts stated, a radical change must be made in the estimates.

WATER LEVEL OF GREAT LAKES DROPPING

Let us now look at the water record. A chart, "United States Lake Survey, Monthly Mean Water Levels of the Great Lakes from Official Records, 1860 to 1905 and 1905 to Date," shows, in profile, the mean levels of the five Great Lakes for each month of the years stated. The Precise Water Level Division of the Canadian Hydrographic Service issues mimeographed sheets monthly, and summary sheets annually, showing mean lake levels for four of the Great Lakes and for Montreal Harbor. The figures and tables accompanying this article are taken from or deduced from these two sources.

These annual sheets also show the "mean level" over ten-year periods, for these bodies of water. The mean values for the levels of Lake Superior, Lake Ontario, and Montreal harbor over ten-year periods are shown in Fig. 1. In Fig. 2 are shown the mean monthly levels of Lake Ontario from January to December 1935, exclusive. The 1934 annual sheet for Lake Ontario contains the following note: "Elevations, in feet above mean sea level referred to U. S. Lake Survey datum 1903 adjusted at Oswego, minus 0.12 ft, 1860–1894; at Kingston 1895–1934."

For purposes of comparison, the gage readings for Lake Ontario, at Oswego and Kingston, are given for a 12-month period in Table I. The Oswego readings were secured from the U. S. Engineer Office in Buffalo, N.Y., and the Kingston readings from the Department of Marine, Ottawa, Canada.

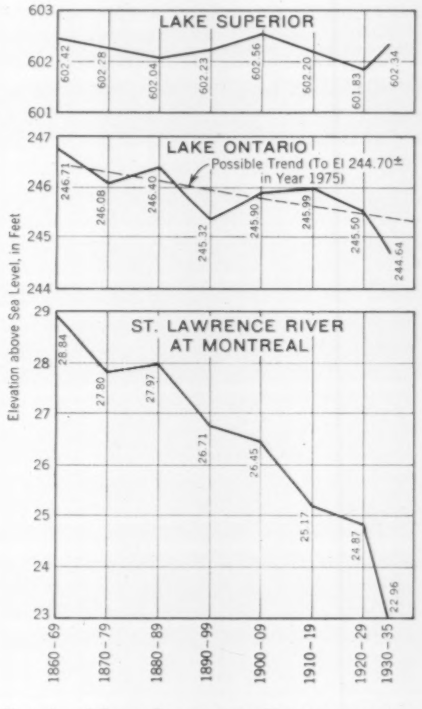

FIG. 1. MEAN LEVELS BY DECADES, FROM THE CANADIAN HYDROGRAPHIC SERVICE

The U. S. Engineer Office at Buffalo gives the discharge of the St. Lawrence River, with lake level at El. 246.03, as 238,000 cu ft per sec, and assumes a mean variation in discharge for each foot of lake-level variation, of 21,100 cu ft per sec. Applying these data to the flows suggested by Mr. Hogg, it will be readily seen that a lake level of 245.89 will give a flow of 235,000 cu ft per sec and that a lake level of 244.70 is required for a flow of 210,000 cu ft per sec.

TABLE I. GAGE READINGS FOR LAKE ONTARIO

YEAR	MONTH	GAGE		DIFFERENCE
		Oswego	Kingston	
1935	September	243.66	243.54	0.12
	October	243.29	243.19	0.10
	November	243.13	242.98	0.15
	December	243.09	242.92	0.17
1936	January	243.04	242.86	0.18
	February	242.83	242.68	0.15
	March	243.48	243.33	0.15
	April	245.02	244.87	0.15
	May	245.26	245.12	0.14
	June	245.08	244.96	0.12
	July	244.78	244.65	0.13
	August	244.25	244.13	0.12

From December 1919 to January 1928, the peaks of monthly mean levels on Lake Ontario exceeded 245.89 five times and the hollows were below 244.70 four times. There was a major return which reached 248.45 in June 1929 and 248.10 in June 1930. Since this latter date the elevation has been dropping continually until, in December 1934, it was 242.55 on the Kingston gage.

POTENTIAL POWER SHOWS STEADY DECREASE

For a general study of this question, let us assume that the entire flow of the river can be used for power, neglecting the requirements for navigation and the 20,000 cu ft per sec which has been diverted for many years for power at Massena. Table II has been prepared on the assumption that the first three months of the year are primary-power months only, and shows the following points:

1. Power possibilities were spotty in 1931, even using the entire flow of the river. In January, February, March, and April, prime power could just be obtained, but deficiencies for the last four months totaled 54,860 cu ft per sec. The 25,000 cu ft per sec additional needed to generate secondary power was not available during the last four months, nor was it available for 76 per cent of the time during the first five months.

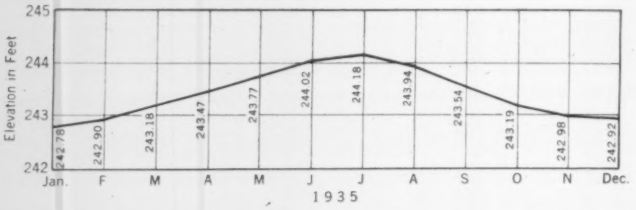

FIG. 2. MONTHLY MEAN LEVELS OF LAKE ONTARIO FOR 1935 FROM THE CANADIAN HYDROGRAPHIC SERVICE

2. The year 1932 opened with a deficiency in water for primary power of about 4 per cent. Full primary water was obtained from February to September, inclusive, the year ending with a loss of 5 per cent.

3. The year 1933 opened with a deficiency in water for prime power of 5 per cent and the only months in which full prime power could have been obtained (unless secondary water was substituted) were May, June, and July.

4. The year 1934 opened with a loss for January of 11 per cent of primary water and closed with a loss for December of 21.5 per cent. At no time during this year was any secondary water available.

5. The year 1935 opened with a deficiency in primary water in January of 40,500 cu ft per sec, and December showed a similar deficiency of 37,400 cu ft per sec, equal to 19 and 18 per cent, respectively. At no time during

TABLE II. LAKE ONTARIO LEVELS IN RELATION TO THE PRODUCTION OF PRIMARY AND SECONDARY POWER

DATE	MEAN MONTHLY LAKE LEVEL	LEVEL NEEDED	210,000 CU FT PER SEC PRIMARY POWER			235,000 CU FT PER SEC SECONDARY POWER		
			Difference in El.		Deficiency Cu Ft per Sec per Mo.	Difference in El.		Deficiency Cu Ft per Sec per Mo.
			Plus	Minus		Plus	Minus	
1931								
Jan.	244.81	244.70	0.11	..	....	..	..	....
Feb.	244.58	244.70	..	0.12	....	..	..	....
Mar.	244.48	244.70	..	0.22	....	..	..	....
April	244.83	245.89	0.13	..	....	..	1.06	22,366
May	245.00	245.89	0.30	..	....	..	0.89	18,779
June	245.28	245.89	0.58	..	....	..	0.61	12,871
July	245.12	245.89	0.42	..	....	..	0.77	16,247
Aug.	244.73	245.89	0.03	..	....	..	1.16	24,476
Sept.	244.43	245.89	..	0.27	5,697	..	..	....
Oct.	244.11	245.89	..	0.59	12,449	..	..	....
Nov.	243.89	245.89	..	0.81	17,091	..	..	....
Dec.	243.77	245.89	..	0.93	19,623	..	..	....
1932								
Jan.	244.26	244.70	..	0.44	9,284	..	..	....
Feb.	244.91	244.70	0.21	..	....	..	..	....
Mar.	245.06	244.70	0.36	..	....	..	..	....
April	245.67	245.89	0.97	..	....	..	0.22	4,642
May	245.98	245.89	1.28	..	....	0.09	..	....
June	245.86	245.89	1.16	..	....	..	0.03	633
July	245.73	245.89	1.03	..	....	..	0.16	3,376
Aug.	245.41	245.89	0.71	..	....	..	0.48	10,028
Sept.	244.86	245.89	0.16	...	....	..	1.03	21,733
Oct.	244.43	245.89	..	0.27	5,697	..	..	....
Nov.	244.28	245.89	..	0.42	8,862	..	..	....
Dec.	244.19	245.89	..	0.51	10,761	..	..	....
1933								
Jan.	244.21	244.70	..	0.49	10,339	..	..	....
Feb.	244.13	244.70	..	0.57	12,027	..	..	....
Mar.	243.99	244.70	..	0.71	14,981	..	..	....
April	244.60	245.89	..	0.10	2,110	..	..	....
May	245.13	245.89	0.43	..	....	..	0.76	16,036
June	245.23	245.89	0.53	..	....	..	0.66	13,926
July	244.99	245.89	0.29	..	....	..	0.90	18,990
Aug.	244.59	245.89	..	0.11	2,321	..	..	....
Sept.	244.25	245.89	..	0.45	9,495	..	..	....
Oct.	243.80	245.89	..	0.90	18,990	..	..	....
Nov.	243.36	245.89	..	1.34	28,274	..	..	....
Dec.	243.30	245.89	..	1.40	29,540	..	..	....
1934								
Jan.	243.58	244.70	..	1.12	23,632	..	..	....
Feb.	243.61	244.70	..	1.09	22,999	..	..	....
Mar.	243.67	244.70	..	1.03	21,733	..	..	....
Apr.	244.15	245.89	..	0.55	11,605	..	..	....
May	244.31	245.89	..	0.39	8,229	..	..	....
June	244.10	245.89	..	0.60	12,660	..	..	....
July	243.85	245.89	..	0.85	17,935	..	..	....
Aug.	243.39	245.89	..	1.31	27,641	..	..	....
Sept.	243.50	245.89	..	1.20	25,320	..	..	....
Oct.	242.84	245.89	..	1.86	39,246	..	..	....
Nov.	242.57	245.89	..	2.13	44,943	..	..	....
Dec.	242.55	245.89	..	2.15	45,365	..	..	....
1935								
Jan.	242.78	244.70	..	1.92	40,512	..	..	....
Feb.	242.90	244.70	..	1.80	37,980	..	..	....
Mar.	243.18	244.70	..	1.52	32,072	..	..	....
Apr.	243.47	245.89	..	1.23	25,953	..	..	....
May	243.77	245.89	..	0.93	19,623	..	..	....
June	244.02	245.89	..	0.68	14,348	..	..	....
July	244.18	245.89	..	0.52	10,972	..	..	....
Aug.	243.94	245.89	..	0.76	16,036	..	..	....
Sept.	243.54	245.89	..	1.16	24,476	..	..	....
Oct.	243.19	245.89	..	1.51	31,861	..	..	....
Nov.	242.98	245.89	..	1.72	36,292	..	..	....
Dec.	242.92	245.89	..	1.78	37,358	..	..	....
1936								
Jan.	242.86	244.70	..	1.84	38,824	..	..	....
Feb.	242.68	244.70	..	2.02	42,622	..	..	....
Mar.	243.33	244.70	..	1.37	28,907	..	..	....
Apr.	244.87	245.89	0.17	..	....	..	1.02	21,522
May	245.12	245.89	0.42	..	....	..	0.77	16,247
June	244.96	245.89	0.26	..	....	..	0.93	19,623
July	244.65	245.89	..	0.05	1,055	..	...	....
Aug.	244.13	245.89	..	0.57	12,027	..	..	....

this year was the shortage of primary water less than 10,000 cu ft per sec.

6. The year 1936 opened with a January deficiency in primary water of 38,800 cu ft per sec, and August showed a similar deficiency of 12,000 cu ft per sec. Apparently the cycle of change is on the up grade, as the months of April, May, and June showed lake elevations slightly higher than those required for primary water (El. 244.70).

A graphical representation of the preceding paragraphs 1 to 6, inclusive, is given in Fig. 3.

AVAILABLE DEPTH FOR STORAGE

In the discussion previously referred to, Mr. Hogg has based his conclusions on a flow of 235,000 cu ft per sec and a regulated lake Ontario level of 246.32, but even provided that the flow is regulated, will the water be used for storage purposes or to provide navigation at the regulated level? The U. S. Lake Survey gives the fall in the St. Lawrence River as 0.87 ft in a distance of about 70 miles (to Ogdensburg) with the lake level at El. 244.00. Crysler Island, the site of the upper dam, is 28 miles below Ogdensburg. For purposes of comparison let it be assumed that the fall from the lake to the Crysler Island dam will be 1.32 ft. With the lake at 246.32, the dam crest at 242.00, and the proposed plant at the dam drawing on the lake storage, the depth of available storage will be 3.00 ft.

The area of Lake Ontario is 7,540 sq miles and that of the St. Lawrence River above Crysler Island may be taken as 260 sq miles (rough scaling from the U. S. Lake Survey chart gave 257.5 sq miles), making a total storage area of 7,800 sq miles. This is equal to 217,451,520,000 sq ft, or as many cubic feet per foot of depth. If we call it 217.5 billion cubic feet, then 3 ft of depth would equal 652.5 billion cubic feet of storage. With full storage available on July 31, 1933, this would have provided primary water to about the middle of September 1934, assuming that all water above the storage plane is available for power.

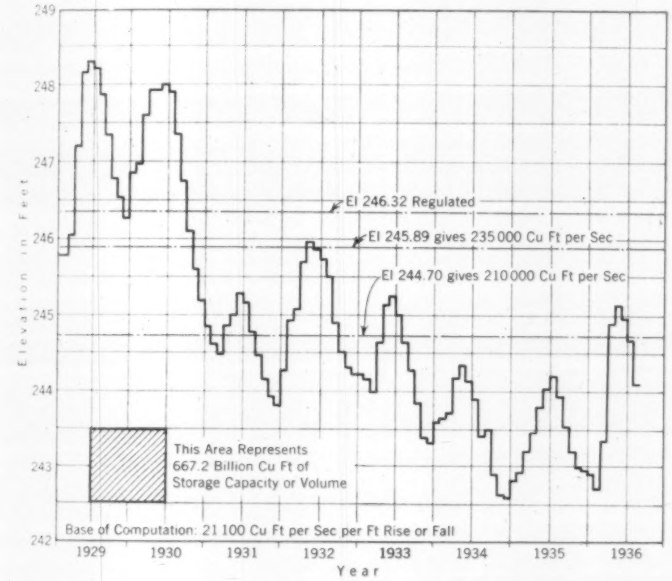

Fig. 3. Mass Profile of Monthly Mean Elevations of Lake Ontario

Water Levels from the Canadian Hydrographic Service

From July 1933 to April 1936 there was no secondary water. For all practical purposes no secondary water has been available for the last six years, as the small amounts shown in the summers of 1931, 1932, 1933, and 1936 should have been saved for primary power in the fall months. The annual trend is shown in Table II.

LONG-TERM TRENDS ALSO DOWNWARD

The "General Data of Lake Ontario," issued by the Canadian Hydrographic Service for 1934, states that the mean elevation for Lake Ontario for the 40-year period from 1860 to 1899 is 246.13 and for the 35-year period from 1900 to 1934 is 245.67. If the trend for the next forty years (until 1975) is taken from the ten-year mean shown in Fig. 1, the mean elevation will be not far from 244.70 at the end of the period. Surely a project of this magnitude and probable cost should not be predicated on a useful life of less than fifty years.

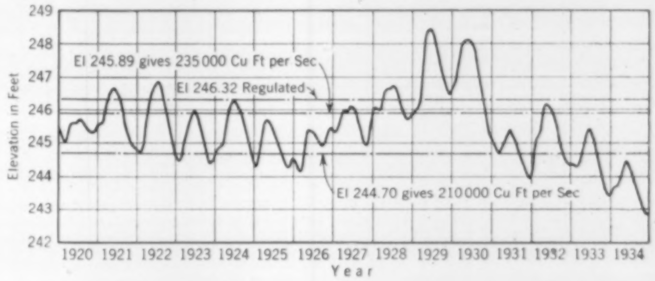

Fig. 4. Monthly Mean Water Levels of Lake Ontario

From Official Records of the U. S. Lake Survey, 1920–1934

In a report on the St. Lawrence development published by the Brookings Institution, the necessity or advisability of a steam auxiliary was mentioned. No government, federal, or state, assumes the necessity or estimates the cost of such an auxiliary. The New York report (State of New York, Report of the Saint Lawrence Power Development Commission; Submitted January 15, 1931) states on page 66:

> "The best way to use the St. Lawrence power . . . would be to use a certain portion of it at the site in continuous industries, and to distribute the balance in the existing market where it could be mingled with power from other sources, such as steam-generated electricity and power from inland streams controlled by storage. In this case the power from the St. Lawrence could be used on that portion of the load which is continuous, and the fluctuations of daily and seasonal use would be taken by the other more flexible sources."

This quotation shows that auxiliary power has been considered, but the cost of its operation has not been included in the government estimates. The responsibility for furnishing the needed auxiliary power is placed on the private corporations expected to purchase power.

The history of hydroelectric developments is a painful one to many of the original investors. The years 1920 to 1927 can now be called warning years. Looking at these warning years and assuming that storage for power is permitted to El. 246.32, that all water can be used for power, and that only water above the storage level can be used for any deficiency in secondary water, the record, shown in Fig. 4, indicates that in 1923, 1925, and 1926 the secondary water was deficient about 78 per cent, 82 per cent, and 75 per cent, respectively. Also, during the eight years, 1920 to 1927, inclusive, it was deficient about 30 per cent of the time. In 1923, 1924, 1925, and 1926 it would have been necessary to draw upon storage between El. 245.89 and 246.32 to hold the primary water to 210,000 cu ft per sec unless secondary water were used to make up the deficiency. In view of the foregoing facts, it seems evident that existing government estimates should be revised.

Beach Erosion in Southern California

Protective Structures Needed to Offset Reduction of Stream Sand Supply by Conservation Works

By the late C. M. Cram
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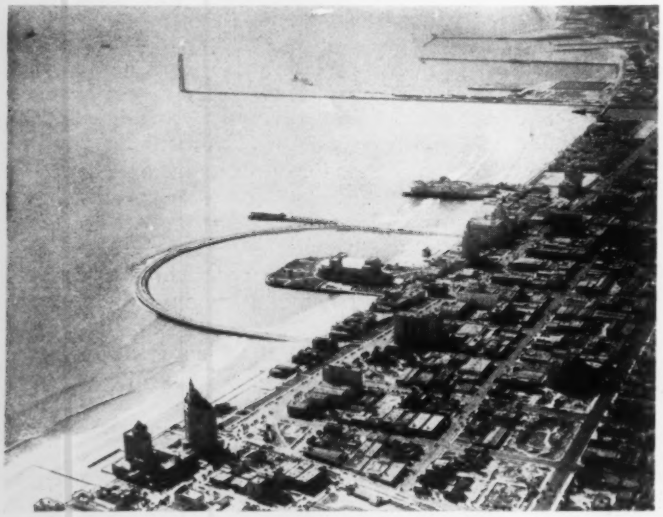
Harbor and Marine Engineer, Long Beach, Calif.

Beach erosion along the coast of Southern California constitutes a serious problem. As a result of his study of this subject, the late Mr. Cram prepared a paper which was delivered sometime ago by A. L. Sonderegger, M. Am. Soc. C.E., before a meeting of the Engineers Club of Orange County, California. The following article, which is abstracted from this paper, maintains that the principal sources of sand along the Southern California coast are rivers, that as a result of the construction of numerous irrigation and flood control works along these rivers, the supply of beach sand is diminishing, and that erosion control works for beach protection are therefore in order. The illustrations were furnished by Mr. Sonderegger.

The natural processes of distribution and ultimate destruction of the ocean sands which compose the beaches along the southern part of the Pacific Coast are impressive. When picked up and churned in the surf, the sand grains are subjected to continuous abrasion, caused by their coming into contact with one another. As a result, the grains are worn down to such fineness that they are held in suspension by the waters of the ocean until carried to its undisturbed depths. During the churning process, some of the grains are deposited on the shore beyond the reach of the usual waves, whence they are either blown onto the uplands by the prevailing sea winds, or are carried back into the surf by higher seas and again subjected to the processes of disintegration. Although the rate of destruction of ocean sands varies with the severity of the elements, the process is continuous, and in consequence any given supply of sand will last only a limited time, considered in terms of years.

Detritus carried by streams in flood flow constitutes the main source of sand supply. The soil along the upper reaches of the larger streams is generally a decomposed granite, which is dislodged and moved even with moderate rainfall; while in their lower elevations the streams traverse terrain which is subject to rapid erosion. In each individual watershed, the products of erosion are moved along at rates varying with the volume of stream flow, until the shore is reached, when the detritus is deposited to form beaches.



Streams Are the Principal Source of Beach Sand Supply
Long Beach, Calif., Showing Accretion at the Mouth of the Los Angeles and San Gabriel Rivers

There is also some erosion by the sea of portions of the uplands which are exposed to its direct impact. The products of such erosion are carried to beaches on either side of the eroded headlands. However, the uplands which extend into the sea in this vicinity are usually rock-bound and have not receded appreciably within the memory of man, while large quantities of detritus are deposited on the ocean shore during the flood flows of streams. These facts prompt the conclusion that the average quantity of sand annually deposited on the ocean beaches of Southern California through the erosion of exposed uplands is negligible in comparison with that deposited during flood flows.

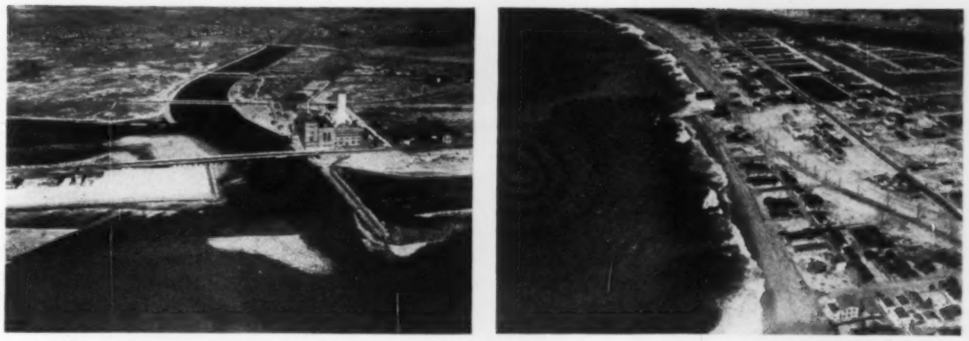
It is to be concluded that the beaches of Southern California are practically dependent for existence on the supply of detritus delivered to them by streams, and that, if they are to continue in existence, the quantity supplied must equal the quantity which the seas possess the power to destroy.

HEADLANDS LOCALIZE SAND DISTRIBUTION

The coast line of Southern California consists of alternate stretches of sandy beaches and jutting headlands or points, usually rock-bound and barren of ocean sands. The more prominent headlands often rise nearly vertically from the seas, while others of less abrupt slope are faced on the seaward side by boulder-strewn ocean bottoms. It is believed that ocean sand does not pass around major headlands of either type. In the case of the more abrupt headlands, the ocean depths immediately to seaward are in excess of the minimum depths in which sand is lifted by the waves. In the case of the less abrupt headlands, there is no sand or evidence of sand-scouring action on the boulders and ledges forming their wetted shores. It is therefore generally understood that beaches are maintained by relatively local supplies of sand.

Along unrestricted beaches, where the strip of wetted sand forming the ocean beach is not merged with the more compact soil of the uplands, the beach consists of two strips or zones. That portion lying between the line of ordinary shoreward reach of the seas and the low-water mark, and ordinarily traversed by the uprush and backwash of the waves as the tides rise and fall, is referred to as the foreshore. The backshore lies to landward of the foreshore and is subject to the wash of waves only during exceptional storms.

The surface of the foreshore assumes a well-defined slope, which is most abrupt at the seaward limit of the backshore and drops in elevation from that point seaward at a gradually decreasing rate to assume a uniform slope near the low-water mark. The surface of the backshore is generally nearly level. The sand on its



Santa Monica Breakwater Gave 500,000 Cu Yd Accretion by January 1936

Newport Beach, North of the Sheet-Pile Groin, Receded 120 Ft in Three Weeks

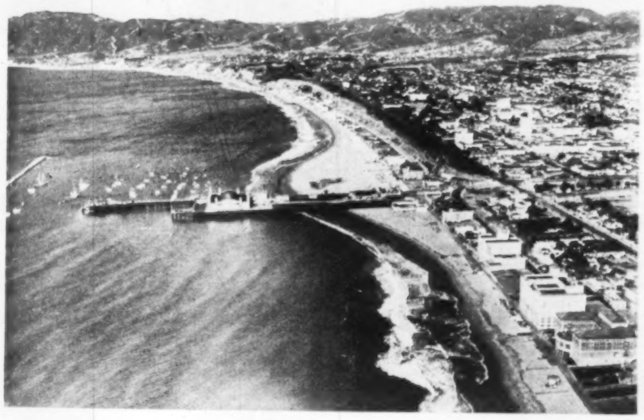
BEACH PROTECTION WORKS PROVE VERY EFFECTIVE AT POINTS ON THE CALIFORNIA COAST

surface is dry except during severe storms, and is subject to movement in prevailing winds. Where there is both a foreshore and a backshore, the average annual width and slope of the foreshore at a given point remain fairly constant. Minor daily and monthly changes result from variations in the combined influence of winds, waves, and tides. Perceptible departures from the average width and slope take place during periods of storm, but the foreshore returns to its normal width and slope when weather conditions improve.

On the other hand, the width of the backshore is subject to vicissitudes from day to day, from month to month, and from year to year, as the result of daily, monthly, and yearly variations in the combined influence of winds, waves, tides, and sand supply. As has been stated, the supply of sand to any given stretch of beach depends upon the quantity of detritus brought down during the flood flow of the streams emptying into the sea in that stretch; and this in turn depends upon the amount and rate of rainfall on the watersheds, the amount and nature of vegetation on such watersheds, the resistance to flow offered by beds and banks in the lower reaches of the streams, and other lesser influences.

CONSERVATION WORKS UPSET NATURAL BEACH CONDITIONS

In the original scheme of nature a balanced condition probably prevailed; that is, the average total quantity of detritus carried by streams to form the sands of any given stretch of beach equaled, or balanced, the average total quantity of detritus that the seas prevailing along that beach possessed the power to disperse or destroy.



TRAINING WORKS AT ESTUARY OF THE SAN GABRIEL RIVER, LOOKING NORTH

The Jetties Are 437 Ft Apart. Normal Littoral Drift Southeast

As Southern California was settled and as natural resources were developed during the past half century, the waters of the streams were impounded and the flood waters were properly conserved for distribution to agricultural lands through the arid months of the year. But the secondary effect of each impounding works has been to intercept the detritus originally carried by the streams; to materially reduce the volume of flood flows below the obstructions; and hence to reduce the capacity of the streams to carry the detritus entering their lower reaches.

There is no more striking evidence of the extent to which the waters of the Los Angeles and San Gabriel watersheds have been appropriated than the act of the Metropolitan Water District of Southern California in reaching out to the Colorado River to augment the supply now available in the basins of these rivers.

WIND, WAVE, AND TIDE CONDITIONS UNCHANGED

The records of the U. S. Weather Bureau for the locality under consideration do not show any definite trend toward either increase or decrease in wind velocities, nor do they show any ultimate change in the direction of prevailing winds. Likewise the records of the U. S. Coast and Geodetic Survey establish no definite trend toward an ultimate change in average tidal heights and fluctuations. Therefore it is concluded that there has been no essential change during recent centuries in the combined influence of winds, waves, and tides along this section of the coast.

It is evident that, of the four phenomena affecting average widths of the beach backshores (winds, waves, tides, and sand supply), only the latter has been basically modified during recent years. Hence, the widths and slopes of beach foreshores have remained relatively constant, but the average annual widths of backshores have diminished during the past two decades. Moreover, backshore widths at the present time are continuing to diminish, and at some points beaches have been stripped of their original backshores. Nature's balance between supply and demand has evidently been broken by the conservation works now in operation in the watersheds of the Los Angeles and San Gabriel rivers. These have so reduced the original and natural supply of sands to the ocean between Point Fermin and the headlands at Corona Del Mar that the backshores still existing between those points are rapidly shrinking. It may also be predicted that the completion of other conservation works now planned and under construction in these watersheds will so materially reduce the supply of sand that ultimately the shore will be practically bare.

When the force of the waves is no longer checked by nature's cushion of sand, the shore will be subject to such a rate of erosion as the seas may establish. As a consequence, human occupation of the uplands bordering the shore between these two headlands will have to be given up and the lands abandoned to the inroads of the sea, or else the present shore must be protected by artificial works. It seems hardly possible that anyone could favor the former course.

Grouting the Foundations of Boulder Dam

Some Valuable Conclusions as to Proper Materials, Equipment, and Procedure

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THREE different systems of holes were used for grouting the foundations of Boulder Dam—shallow low-pressure "B" holes under the upstream part of the dam; deep high-pressure "A" holes, forming a main grouting curtain under the axis of the structure; and high-pressure "C" holes of intermediate depth, providing a supplementary grout curtain under the upstream heel. The field procedure used and the results obtained in grouting these holes, as well as others located under the spillways, weirs, intake towers, and rock abutments, are described in the following article. As a result of the authors' experience at Boulder Dam, certain conclusions as to the best materials, equipment, and procedure for grouting were reached which should prove of value to the engineer charged with carrying out projects of a similar nature. This article constitutes the third in a group of papers on grouting work at Boulder Dam. The first appeared in the September issue, and the second last month.

EXCEPT for a few minor changes, the dam-foundation grouting followed the original plan. In Fig. 1 is shown a plan and elevation of the lower part of the foundation. The complete plan, including tower foundations, appeared as Fig. 2 of the article, "Designs for Grouting at Boulder Dam," by A. V. Werner (CIVIL ENGINEERING for September 1936). A summary of all dam-foundation drilling and grouting is given herein (Table I).

In stripping the foundation preparatory to concrete placement, numerous springs were encountered, and this water was led to the drainage gallery or to the downstream face of the dam through $1^1/_2$-in. pipe headers, as shown in one of the photographs. At the same time, shallow or supplemental "B" holes were drilled at selected locations in the foundation area, and were also piped to the drainage gallery or downstream face of the dam. These contact and drainage holes, numbering approximately 200 in all, were grouted when the dam was nearing completion. The methods and pressures used were similar to those for the "A" line. Designs called for a specialized form of abutment contact-grouting similar to that for the contraction-joint system. It consisted of a piping system over the entire area with outlet boxes spaced approximately 10 ft apart in a checkerboard arrangement. Grout will be pumped into this system after the reservoir has been filled and the dam has taken its maximum deflection.

TABLE I. DAM FOUNDATION DRILLING AND GROUTING SUMMARIZED

LINE	DRILLING, IN LIN. FT			GROUTING, IN CU FT		
	Arizona	Nevada	Total	Arizona	Nevada	Total
A	27,450	26,951	54,401	28,170	31,854	60,024
B	2,851	2,463	5,314	1,783	4,612	6,395
C	4,022	3,303	7,325	2,057	5,049	7,106
Total	34,323	32,717	67,040	32,010	41,515	73,525

Grouting of the near-surface rock through the "B" holes was designed to seal major surface faults and fractures so as to provide a leakproof layer under the upstream part of the dam and also to provide cover for high-pressure injections in the deeper "A" and "C" holes. Except for additional holes along fault lines and in small areas that required special treatment, the "B" holes were spaced about 20 ft apart in a staggered arrangement. Generally, the pressure was limited to about 300 lb per sq in., but a maximum of 400 lb was applied in many cases. The holes ranged from 30 to 50 ft deep and were drilled with air-hammer drills, wagon drills, or diamond drills, according to their depth and location. It was necessary to use diamond drills on the precipitous cliffs in the abutments. Holes were collared and grout connections installed by high scalers at the same time the drilling platforms were built.

Standard neat portland-cement grout having a water-cement ratio ranging from 1 to 5 by volume was used for "B" holes throughout. All holes were washed by pumping water into them at full grouting pressure, or to the capacity of the pump, for a period not exceeding five minutes. At this time the tightness of the grout connection, valves, and pipe line was tested, as well as the performance of the pump. Likewise, the rate at which the hole took water was an indication of what might be expected when grout was injected, and helped to determine the probable water-cement ratio to be used. Preliminary calking of leaks, where required, was done before any grout was pumped into the hole. It was observed that many leaks were preceded by a copious flow of mud of varying consistency.

Grouting was done with a portable grouting unit mounted on a truck, similar to those used in pressure-grouting the tunnels. A summary of the "B" schedule of grouting appears in Table II.

"A" HOLES GROUTED AFTER SEALING SURFACE

The "A"-line grouting, which forms the cutoff curtain under the dam, was not begun until at least 100 ft of

TABLE II. "B"-HOLE DRILLING AND GROUTING

NO. OF HOLES	DEPTH, IN FEET			CEMENT, IN SACKS		
	Nominal	Total	Average	Total	Per Hole	Per Foot
			Nevada Side			
36*	30	1,055.5	29.31	2,360	65.55	2.235
12†	40	489.5	40.79	1,558	129.8	3.182
20	50	942.1	47.10	686	34.3	0.728
			Arizona Side			
37	30	1,130.3	30.54	1,405	37.97	1.243
16	40	589.1	36.82	465	29.06	0.789
22	50	1,006.6	45.75	190	8.63	0.188
			Total			
73	30	2,185.8	29.94	3,765	51.57	1.722
28	40	1,078.6	38.52	2,023	72.25	1.875
42	50	1,949.7	46.40	876	20.85	0.449
143	..	5,213.1	36.45	6,664	46.60	1.278

* Hole No. 25NB1 of this group took 1,426 sacks.
† Hole No. 12NB3 of this group took 1,308 sacks.

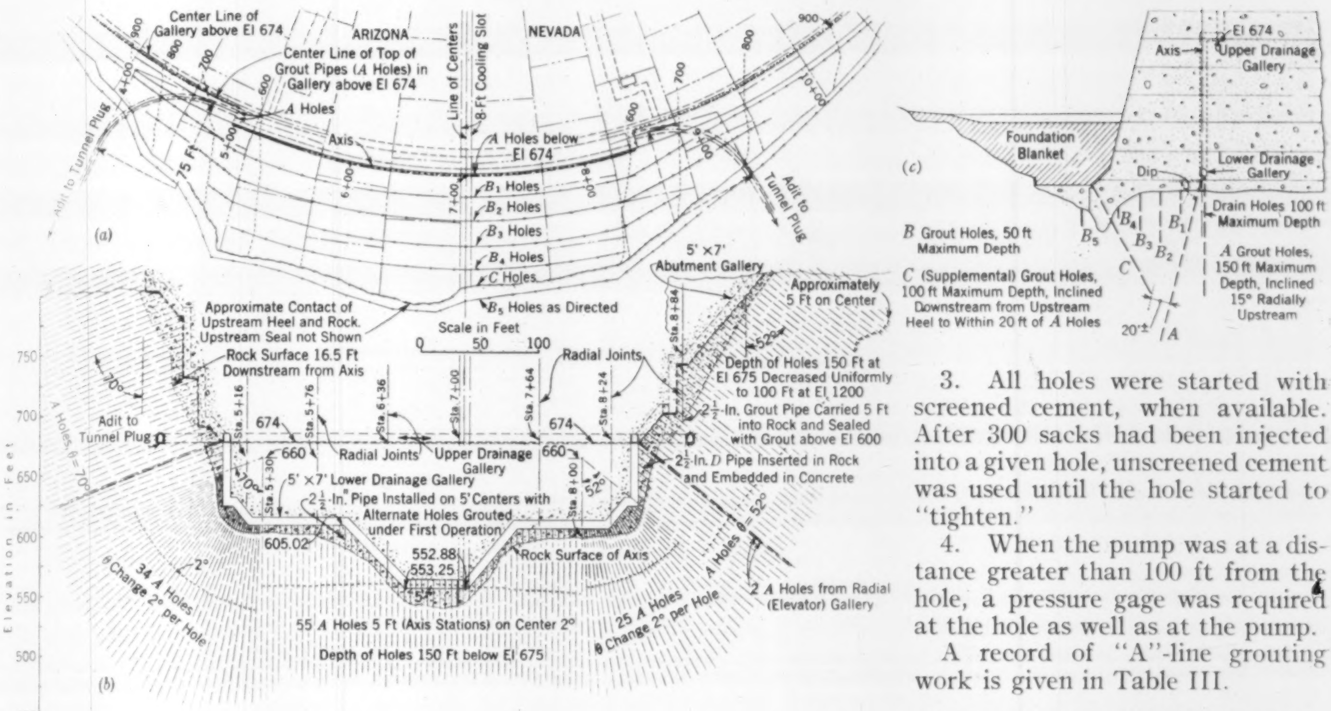

Center Line of Gallery above El 674
ARIZONA
NEVADA
Center Line of Top of Grout Pipes (A Holes) in Gallery above El 674
A Holes
Axis
Line of Centers
8-Ft Cooling Slot
A Holes below El 674
B1 Holes
B2 Holes
B3 Holes
B4 Holes
C Holes
B5 Holes as Directed
900
800
700
600
4+00
5+00
6+00
7+00
8+00
9+00
10+00
75 Ft
Adit to Tunnel Plug
Adit to Tunnel Plug
(a)
Scale in Feet
0
50
100
5' ×7' Abutment Gallery
Approximately 5 Ft on Center
Approximate Contact of Upstream Heel and Rock. Upstream Seal not Shown
Rock Surface 16.5 Ft Downstream from Axis
70°
Adit to Tunnel Plug
A Holes, θ=70°
Sta. 5+16
Sta. 5+76
Sta. 6+36
Sta. 7+00
Sta. 7+64
Sta. 8+24
Sta. 8+84
Sta. 5+30
Sta. 8+00
674
674
660
660
Radial Joints
Radial Joints
Upper Drainage Gallery
5' ×7' Lower Drainage Gallery
2½-In. Pipe Installed on 5' Centers with Alternate Holes Grouted under First Operation
605.02
552.88
553.25
5'
70°
52°
52°
Rock Surface of Axis
Depth of Holes 150 Ft at El 675 Decreased Uniformly to 100 Ft at El 1200
2½-In. Grout Pipe Carried 5 Ft into Rock and Sealed with Grout above El 600
2½-In. D Pipe Inserted in Rock and Embedded in Concrete
A Holes θ = 52°
2 A Holes from Radial (Elevator) Gallery
34 A Holes θ Change 2° per Hole
2°
55 A Holes 5 Ft (Axis Stations) on Center 2°
Depth of Holes 150 Ft below El 675
25 A Holes θ Change 2° per Hole
(b)
Elevation in Feet
750
700
650
600
550
500
450
(c)
El 674
Axis
Upper Drainage Gallery
Foundation Blanket
Lower Drainage Gallery
Dip
Drain Holes 100 ft Maximum Depth
B Grout Holes, 50 ft Maximum Depth
C (Supplemental) Grout Holes, 100 ft Maximum Depth, Inclined Downstream from Upstream Heel to Within 20 ft of A Holes
A Grout Holes, 150 ft Maximum Depth, Inclined 15° Radially Upstream
B1
B2
B3
B4
B5
C
A
20'±

Fig. 1. Foundation Grouting at Boulder Dam Below El. 800
(a) Plan of Grout Holes, (b) Developed and Projected Elevation on Dam Axis, (c) Sectional Elevation on Radial Plane

concrete, placed over the site of the hole, had been cooled and the joints grouted. The following maximum grouting pressures were tentatively outlined on the drawings, to be modified by local conditions when and where necessary:

Below El. 800	1,000 lb per sq in.
From El. 800 to El. 1,000	750 lb per sq in.
Above El. 1,000	500 lb per sq in.

Drilling was done from galleries in the dam by three or more portable diamond drills. Before the dam concrete was placed, holes were drilled 5 ft into the rock, and $2^1/_2$-in. pipes leading to the gallery were embedded in the concrete on 5-ft centers.

The mixers for the greater part of the work were located on platforms built for that purpose on the downstream face of the dam, although grout for the upper quarter of the "A" line was mixed on the crest of the dam. The pumps were located in the radial or circumferential inspection galleries. In the first set-up, for example, the pump was placed in the gallery at El. 553 and the mixer at the inner end of the Arizona gallery at El. 704. Cement was delivered to the portal of the gallery by cableway and was hand-trucked through the gallery to the mixer. From the mixer the grout was conveyed through a gravity pipe line 2 in. in diameter, to a mechanically agitated sump located near the pump. Telephone and signal systems connected the pump and the mixer to make possible control of quantity and quality of grout. An extensive communication system developed from this simple beginning.

The following general grouting procedure was followed:

1. When there were grout leaks into the abutment systems, porous tile drains, or contraction joints, the grout was thickened to a water-cement ratio of 0.75. After pumping a small amount of grout, the hole was abandoned.
2. Water was circulated through the abutment systems at all times when "A"-line or "C"-line grouting was in progress.
3. All holes were started with screened cement, when available. After 300 sacks had been injected into a given hole, unscreened cement was used until the hole started to "tighten."
4. When the pump was at a distance greater than 100 ft from the hole, a pressure gage was required at the hole as well as at the pump.

A record of "A"-line grouting work is given in Table III.

GROUTING SUPPLEMENTAL CUTOFF HOLES

"C"-line grouting, which provided a supplemental cutoff under the heel of the dam, followed the upstream outline of the dam from its lowest point to El. 775 on each abutment. Grouting was discontinued at this elevation, with the idea that if additional grouting were necessary to supplement the "A" line, the holes could be later drilled to better advantage from the abutment drainage galleries. It now appears that such supplemental grouting may be unnecessary.

Table III. Summary of Cut-off or "A"-Line Grouting

Grouting	No. of Holes	No. of Sacks	Sacks per Hole
Nevada side:			
Primary	63	25,691	408
1st intermediate	62	1,966	31
2d intermediate	40	586	14
3d intermediate	23	243	10
Arizona side:			
Primary	55	15,596	283
1st intermediate	34	5,925	174
2d intermediate	26	1,093	42
3d intermediate	22	1,092	50
4th intermediate	5	380	76
5th intermediate	2	196	98

Drilling of the holes was carried on as usual to the required depths. Working platforms were supported by bolts recessed and threaded in the end to receive the tie rods and placed in the upstream fillet of the dam to secure the forms. Grout was placed with one of the portable truck-mounted grouting outfits previously referred to. Pressures varied from 500 to 750 lb per sq in.

The original design contemplated grouting the "A" line in advance of the "C" line. However, it became necessary to reverse this program in order to finish the "C" line before the storage of water in the reservoir began. Hence, after 11 primary holes within the inner gorge on the "A" line had been grouted, this work was temporarily discontinued until all the "C" holes on the canyon floor along the upstream edge of the dam had been drilled and grouted. At this stage, six selected holes on the "A" line were core drilled in order to secure data on the travel of the grout and a check on the hole spacing. The cores recovered showed but few fissures, and these were minute in character with few traces of grout.

Grouting of the "C" line was done progressively; that is, a hole was drilled and grouted before the succeeding hole was drilled, but in order to speed up the work, the progressive method was not strictly enforced on the "A" line. The contractor was allowed to drill any number of holes without being required to redrill an infected hole so long as the grout, in traveling from one hole to another, passed a hole that had already been grouted. When such conditions occurred, all holes were connected to the pump and grouting continued alternately on each hole at intervals of from 10 to 15 minutes.

SPRING WATER WAS CONDUCTED TO THE GROUT GALLERIES THROUGH $1^1/_2$-IN. PIPE HEADERS

ABUTMENTS GROUTED FROM TUNNELS

The grout curtain was extended into the abutments by deep drilling and grouting of high-pressure holes from tunnels No. 2, 3, 4, 5, and 6. Drilling was done from movable scaffolds called "jumbos." All holes were collared with drifter drills and the deeper holes were drilled with diamond drills. Except that stage grouting was not used elsewhere, all this work conformed closely to that done above the plug in tunnel No. 4.

Grouting of diamond-drilled holes above the plug in tunnel No. 4 was begun by day shift, March 7, 1935, with approximately 100 ft of water in the reservoir, and finished by the same shift April 23, 1935. All regular high-pressure grouting upstream from the plug in this tunnel had been finished more than a year before, the first high-pressure grouting on the project having been done in this particular reach of tunnel No. 4. Since the first grouting was done, the tunnel had twice been used for diversion. Temperature changes had reopened the contraction joints, thus admitting some water from the reservoir into the tunnel. An inspection showed that in those reaches of the tunnel which had been high-pressure grouted, leakage was limited to a small trickle of water from most of the transverse joints and an occasional longitudinal shrinkage crack. Where the tunnel had not been grouted at high pressure, the leakage was much more profuse, the water spurting out with considerable force in several instances. The water surface of the reservoir was at El. 720 ± at the time.

Grouting was begun through some of the 50-ft holes, but the grout traveled freely, showing at joint after joint for a distance of more than 400 ft in some instances. It was believed that no advantage could be gained by deep drilling until these surface leaks had been sealed. Drilling of the 50-ft holes was therefore discontinued and grouting of the tunnel lining from selected 10-ft holes was done preliminary to drilling and grouting the deeper holes, the same routine being used in each case.

Diamond-drilled holes were not washed with a blowpipe, but with water through the drill-rods. Pressure washing was limited to a period of five minutes and was primarily for the purpose of testing the tightness of the grout line and the connection to the hole.

All grouting work was directed and supervised by a Bureau engineer with such assistants and inspectors as were required. The contractor's organization consisted of drilling and grouting crews under the supervision of competent foremen. The drill crews were organized to function equally well with the three different types of drills. The average crew consisted of the necessary drillers, chucktenders, and nippers to keep four machines in operation. With few exceptions, diamond drillers were generally developed from the more experienced percussion drillers.

CONTRACTOR'S ORGANIZATION EFFICIENT

Shallow grout holes and starting holes for diamond drills were drilled with air-hammer drills. Wagon-type percussion drills were used for "B" holes 30 to 50 ft deep. Deep holes for high-pressure grouting were drilled with air-driven diamond drills. Most of these holes were drilled with a solid non-coring bit set with bortz, which gave excellent results. In exceptional instances as much as 175 ft in 8 hours was drilled with this type of bit.

Grouting equipment consisted of a grout mixer, a mechanically agitated sump, and two high-pressure sludge pumps. A detailed description and illustrations of this equipment appeared in the preceding article on tunnel grouting. As a result of experience in tunnel and contraction-joint grouting, many improvements were made in the design of the mixer, most of which were suggested by J. B. Hays, M. Am. Soc. C.E.

An important and very useful feature was the communication system. Metallic-circuit telephone lines having connection plugs at frequent intervals were strung to all galleries in the dam. Grout scouts were provided with test sets and were thereby able to report grout leaks with a minimum of delay. The system was also connected with the works system and communication was thus provided for emergencies and for discussion of unusual difficulties with superiors.

As grouting practices and procedure are to a large extent governed by local conditions, it is obviously impossible to outline a detailed procedure that will be applicable to all jobs. However, as there is very little published data on the subject, the experience and conclusions of those responsible for the work at Boulder Dam may be of benefit to others.

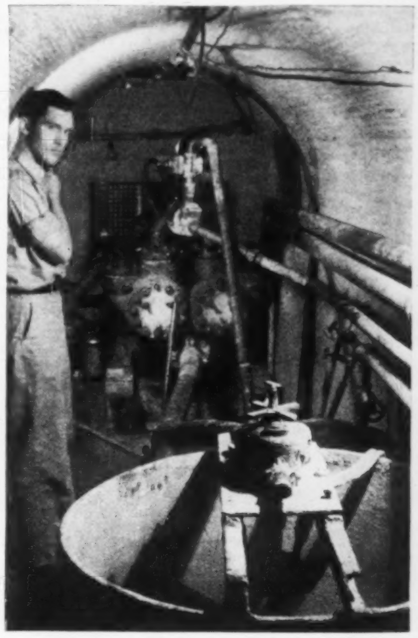
SPECIAL EQUIPMENT NEEDED

Adequate and efficient equipment is essential for successful work. Probably the most important item is the grout pump. The duplex piston-displacement sludge pump is the most satisfactory type for this service, although the best of these requires frequent attention. Factory valves and seats are worn out in a few hours and frequent replacement is necessary. Valves should be inspected daily, preferably after the completion of a hole. Piston and cylinder repairs should be anticipated and made before failure. On a large job it is expedient and economical to have a standby pump hooked up to the grout distribution lines so that grouting operations will not be stopped by pump failure. Mixers and agitators are also important.

Proper mixing of grout and control of the water-cement ratio are essential. Capacity for maximum pumping rate is necessary, and at the same time there must be good control of mixing and agitation while pumping at the minimum rate.

The design of the pipe distribution system should be carefully considered in order to provide sufficient capacity for a large crevice and still maintain a velocity that will prevent the settlement of cement in the pipes when a tight hole is being grouted at a low rate. Frequent flushing of the pump and pipe lines is required to maintain continuous operation and avoid expensive delays while pipes are being cleaned. Obviously, long pipe lines should be avoided as much as possible.

Lubricated plug valves are more satisfactory than ordinary iron cocks and are well worth the difference in cost. Iron cocks are subject to rapid wear and may not safely withstand very high pressure. Pressure gages should be placed at the pump and at the connection with the hole. Gages are most satisfactorily protected by filling the short gage tube with a semi-fluid waterproof grease. This is considered more satisfactory than a rubber diaphragm.



Pumps for Grouting Were Placed in the Circumferential Galleries of the Dam

RECOMMENDED PREPARATORY WORK

The procedure used in pressure-grouting rock formations depends largely upon the character of the rock. Much can be done to increase the grouting efficiency and solidification of badly broken formations. Most crevices are partially, if not entirely, filled with gouge or other material deposited there by infiltration, and there is a tendency for drill cuttings to lodge in and obstruct the smaller fissures quite as effectively as though sand had been injected with the cement. This is true whether percussive or abrasive drilling is used, although somewhat less so with the latter.

Although some of the gouge material is soluble in water, it forms an almost perfect grout stop. Initial injections of even thin grout mixtures may have a tendency to aggravate the situation, but preliminary injection of water at high velocity tends to open up these passages and increase the grouting radius. In comparatively tight rock, it is advisable to flush holes by introducing water at the bottom of the hole through a smaller pipe and washing upward outside the pipe. Dry rock absorbs a considerable amount of the mixing water, and at the first constriction of the grout channel, a part of the water is forced into the rock while the thickened grout remains behind, with the result that it partially blocks the channel and limits the grouting radius of the hole.

For these reasons, all holes should be flushed out immediately preceding the introduction of grout. In a broken rock, nearly full grouting pressure should be applied and maintained as long as there is any noticeable "pickup," or increase in pump speed; however, nothing is gained by pumping large quantities of water into a hole that takes it freely. In a relatively tight rock it might be contended that water will lodge in pockets and seams, occupying space that would otherwise be filled with grout, but it is believed that when under high pressure, the water is forced into the rock pores. If the hole will not take water there is no need of grout in that particular formation.

Since it is logical to assume that higher pressures will give greater penetration, it is desirable for economic reasons to use the greatest pressure safely possible, thus permitting a wider spacing of holes. There is unfortunately no basis for the establishment of a safe maximum pressure other than an arbitrary opinion based upon a study of the rock structures, and experienced judgment. The maximum pressure should not be great enough to disturb the natural formation by lifting parts of the rock from the bedding planes. Grouting in stages, or alternately drilling and grouting a given hole, permits the use of a much higher pressure for each succeeding injection and results in more effective grouting. However, should a small displacement take place, it may be assumed that the injected grout will reunite the fracture when the pressure is released. The minimum pressure should be sufficient to maintain a rapid and continuous flow of grout and prevent clogging in pipes and drill holes, with ample allowance for the pressure required to overcome friction.

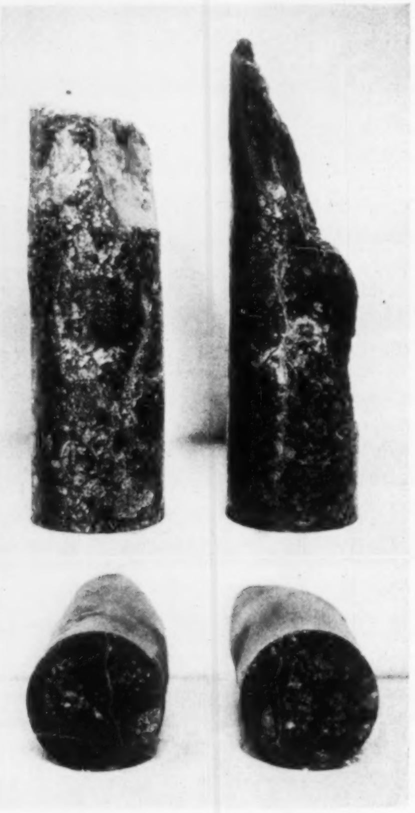
THREE VARIABLES MUST BE COORDINATED

The water-cement ratio, pressure, and rate of pumping should be coordinated by "feeling out" the hole to be grouted. The selection of a proper water-cement ratio is difficult, and many holes have been lost by using a thicker grout than they would accommodate. Pump behavior, rate of cement consumption, and reaction of the hole to changes in water-cement ratio are all valuable aids, but the solution must depend largely upon experienced judgment.

There is no universally accepted consistency that should initiate injection into a hole. Based upon experience at Boulder Dam, the consistency should be such as to permit the engineer to "feel out" the hole in safety, without danger of loss at its inception. The thin grout used initially should be pumped only long enough to arrive at an estimate of the hole's possibilities and enable the operator to proceed intelligently in progressively reducing the water content to the minimum that the hole will tolerate. With abnormally high ratios, the initial grout does not give much information and tends to prolong the period of adjustment. Initial injections of grout having a water-cement ratio equal to $0.01\ S$, where S is the limiting pumping pressure, worked well at Boulder Dam. Thus a 500-lb hole would be started with a grout whose water-cement ratio by volume was 5.0. This value would probably be too low for rocks that are denser than the andesitic breccia at Boulder.

There are two ways of clogging or destroying a high-pressure hole in porous rock, by using a thicker grout than the hole will tolerate at a given rate or pump speed and by pumping very slowly. When grout is flowing slowly, there is a tendency for the size of a given channel to be reduced (by sedimentation) until it approaches the same diameter as the smallest section of the original passage. This action manifests itself by a gradual falling off in the rate at which a hole takes grout—a choking up—as pumping continues. This can be delayed and more grout injected by maintaining a reasonably high pumping speed at all times and injecting clear water into the hole periodically.

Rock Grouting Crew at Work on One of the Abutments of Boulder Dam


High Pressure Is Needed to Grout Seams as Fine as in These Cores

At Boulder Dam the pumping speed was controlled by manipulation of the water-cement ratio. When the speed fell below normal (about 15 forward strokes per minute of each piston), the water-cement ratio was increased proportionately, and vice versa. With the applied pressure maintained constant and the pumping speed approximately so, the rate of cement consumption becomes an index to the type of hole, and the change in rate a measure of its response to the methods being used. These rates were determined at 15-minute intervals during injection, and changes in water-cement ratio were made accordingly.

Near the close of the work it was recommended that for future grouting work, the maximum pressure specified should be obtained by pumping at a constant pressure of from 200 to 300 lb in excess of the desired static or back pressure of the hole, and it was held important to pump at a constant pressure continuously to force the maximum amount of grout into the hole in the shortest possible time.

COMPOSITION OF GROUT IMPORTANT

A neat cement grout was used almost exclusively on the Boulder project. As explained in the previous article on tunnel grouting, the use of a sanded mixture proved undesirable both because of its effect on the pumps and the difficulty of holding the sand in suspension. It seems improbable that the sand is carried far from the hole even when large cavities are penetrated, and consequently the hole spacing should be closer than when neat cement grout is used. The added drilling cost may more than consume any saving in the cost of materials.

A neat grout of standard portland cement is probably the best all-purpose grout. Cements which set very quickly are to be avoided for obvious reasons; those cements that attain their strength slowly are equally objectionable. A bad leak usually means a lost hole, and it is therefore highly desirable that such leaks be permanently sealed when first encountered in order to avoid sacrificing future holes to the same leak. This is difficult with slow-setting or low-heat cements when grouting of an area is continuous. Rescreening the cement also increases the difficulty of stopping leaks.

For injection into tight ground, somewhat greater efficiency can be obtained by the use of extra finely ground and resifted cement. The average cost of rescreening was about 18 cents per sack. It was definitely established that a tight hole will admit as much as 10 per cent more rescreened than ordinary cement in a given interval of time. However, conditions permitting, the apparent advantage can be more than overcome by slightly increasing the pressure applied to ordinary cement. While the use of extra finely ground cement is almost essential in contraction-joint grouting, it is of secondary importance in rock grouting. In the former case, the width of openings and safe pumping pressure can be determined within comparatively narrow limits, and refinements even at considerable expense are warranted, but in the latter case, both the safe pressure and size of openings must be assumed and may be largely in error. While fineness is desirable as an added factor of safety, it is felt that the payment of premium for rescreening is hardly justifiable.

ACKNOWLEDGMENTS

The authors wish to acknowledge their indebtedness to F. A. Backman, superintendent in charge of grouting operations for the contractor, who, with Frank Airington, Ronald Jones, and Roy Woodford, grout foremen, have contributed largely to the success of the work by their cooperation and helpful suggestions; and to W. E. Blomgren, senior engineer of the Denver office, under whom the foundation-grouting designs were prepared. All Bureau of Reclamation work is directed by the Commissioner (the late Elwood Mead, M. Am. Soc. C.E., John C. Page, acting) in Washington, D. C. R. F. Walter, M. Am. Soc. C.E., is chief engineer and J. L. Savage, M. Am Soc. C.E., chief designing engineer. Walker R. Young, M. Am. Soc. C.E., construction engineer, represented the chief engineer on the project.

The Social Responsibilities of the Engineer

Sound Engineering Principles Versus Wishful Thinking in Public Works Policies

By J. K. Finch
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In a letter addressed to the heads of over a hundred engineering schools throughout the country, President Roosevelt asked that educational and "other pertinent professional associations" consider the social responsibilities of the engineer—particularly of the civil engineer. "Events of recent years," he said, "have brought into clearer perspective the social responsibility of engineering . . . . This raises the question whether the curricula of engineering schools are so balanced as to give coming generations of engineers the vision and flexible technical capacity necessary to meet the full range of engineering responsibility."

The opinion of engineers on this question probably varies widely, but the following article attempts to analyze the problem from a viewpoint which, in the opinion of Professor Finch, reflects the position of many in the profession.

On the surface, the President's letter, released to the press on October 22, 1936, seems to contain only a thoughtful and forward-looking suggestion. Its implications, however, must be apparent even to the layman. One is forced to assume that engineering educators have, in the past, neglected this important phase of engineering training, and that the present generation of engineers is not as competent as it should be to deal with problems of this nature. Furthermore, it may be inferred that the President feels that the engineer possesses the key to many of our social problems, but, through this neglect and an unprogressive viewpoint, has failed to make this key available to a nation sorely in need of guidance. Because of its origin and its widespread publication, this document in effect becomes a public reprimand to engineering educators and to the engineering profession.

That the educational problem involved has not been fully solved cannot be denied, but the idea that it has received little or no attention from engineers and engineering educators is absolutely erroneous. There have been numerous studies made of engineering education and of the need for broadening the training of the engineer along economic lines, and of increasing his understanding of the social problems which have arisen in recent years. There is hardly an engineering school in the country but has made some progress in this direction and, in some cases, well-coordinated programs of this type have been in force for almost a quarter century. It is small wonder, therefore, that engineering educators have protested strongly over this feature of the letter.

On the other hand, if it is implied that the engineer of today is unprogressive and incompetent, this is a matter which not only reflects adversely on the engineering profession but also is of importance, if true, to every citizen of this engineering age. If this democracy cannot rely on the skill and competence of the American engineer, then nothing less than the future of our nation is at stake. On this point the engineer is certainly entitled to a hearing and the public to an explanation.

SOCIAL AND ENGINEERING PROBLEMS CONTRASTED

The idea has frequently been expressed that engineering activity has made this an engineering age, that it is the engineer who is responsible for the many perplexing economic and social problems we now face, and therefore, *ipso facto*, it is up to the engineer to solve them. Discussion and protest along these lines will probably continue for many years, although a common-sense consideration of the problem will show that the engineer is not responsible for many of the major difficulties of the situation; that it is, in fact, a general problem of Western civilization; and that engineering, powerful and constructive as it is, possesses no magical key which will unlock the gates to a rosy and peaceful future.

The engineer has, of course, not suffered from a dearth of suggestions from well-meaning but misinformed enthusiasts, as to how this can be done. Many of these problems are peculiar to what has been called a machine age. The obvious need for economic readjustments, the much-discussed problem of technological unemployment, and similar, more general, economic-social difficulties of the present day, have led so-called economists and sociologists, full of ideas but totally lacking in any knowledge of engineering principles or methods, to take it upon themselves to steer the engineer aright. The President's letter, however, appears to have been intended to emphasize the public works element of the problem, particularly the responsibilities of the civil engineer in the field of social rehabilitation and uplift.

During the last few years, the Administration has gone ahead with all sorts of public construction, some of which can be economically justified but much of which must be considered simply planned extravagance in the construction of elaborately useless and ingeniously unprofitable works. Fort Peck, Bonneville, Grand Coulee—and, until common sense at last put an end to them—Passamaquoddy and the Florida Ship Canal represent gigantic but uneconomic constructions.

It may, of course, be argued that it was better to distribute relief funds in this way than to hand out a direct dole. The fact remains, however, that this issue has not been made clear. On the contrary, these relief projects have been brought forward as possessing important economic and social values which justify their construction. The public has been led to believe that we are on the verge of a new era in which, in some mysterious way, the engineer can annihilate costs and provide almost free service for all—only "a lack of vision and flexible technical capacity" on the part of the engineering profession holds up the march into Utopia. The abilities of the profession are thus questioned, and the atmosphere should be cleared if sound progress is to be made.

Throughout the ages, the engineer's principal stock-in-trade has been his reputation for absolute honesty and meticulous care in searching out, analyzing, and appraising the basic facts and economic values of those enterprises in the field of his professional activities. When he has recommended a work, he has staked his reputation and standing on its feasibility and soundness. Almost without exception, engineers damned the Passamaquoddy and Florida projects, but no attention was paid to their statements. Similarly, the white elephant at Fort Peck was begun before any economic study worthy of the name had been made, and the engineers were then called in to say that what had been done was wise and good.

There is the old story of the engineer who was asked by an intelligent female whether engineers could move Pike's Peak to the middle of the Sahara Desert. The answer was, "Yes, but why do it?" The late General Carty, chief engineer of the New York Telephone Company, always asked his assistants three questions about any project submitted to him for approval: "Why do it this way? Why do it at all? Why do it now?"

A bridge may fail physically through errors in structural design or judgment, or it may fail economically through similar errors of economic analysis or judgment. Either failure is an engineering disaster. There are, thus, many completed works which are technically perfect but which are complete engineering failures. Some of these mistakes are unavoidable and they occur in connection with private as well as public undertakings.

In a large measure, progress in engineering is marked by the reduction of engineering technique to a science. Beginning about the time of our Civil War, engineers began to compute stresses from loads, to test materials, and to proportion structural parts to meet the stresses which analysis showed they would be subjected to. This development was supported, as it led to economy.

Through all this period of progress in design, the rationalization of the other basic element of engineering, economic analysis, lagged behind. In large part, this lag has been due to lack of basic economic data rather than lack of methods for handling and appraising such data. Much has been done toward securing data on and perfecting the technique of economic analysis in the field of private engineering enterprise. Even today, however, mistakes are not always avoidable, and many private undertakings still end up as engineering failures.

These observations hold true with far greater force in the field of public investments of an engineering nature. We have not only failed to collect and record much of the basic data which should have been accumulated in over a century of public works construction and administration, but even present methods of public accounting are such that the day will be still further postponed when we will have available the basic data needed for the rational economic analysis of public undertakings. The problem of the intangible benefits is, however, a still more formidable stumbling block.

APPLYING ENGINEERING PRINCIPLES TO PROJECTS

At one end of the scale of public undertakings we have works that are capable of reasonably strict engineering-economic analysis. We can say, with some assurance, that we are reasonably near the truth, that such-and-such a project, costing so much, will bring in the funds necessary to maintain and operate it and to amortize its cost, either in direct returns (such as tolls or assessments) or by creating taxable values which can be drawn upon for these purposes. In short, such a work can be definitely expected to add to the national wealth—to the productive earning power of a community, state, or nation.

At the other end of the scale is the purely social undertaking, possessing, perhaps, some remote and intangible economic implications, but primarily a humanitarian work, constructed for purposes of social uplift, and resting, therefore, on public opinion, on social philosophy, and on humanitarian ideals. Such projects should not be confused with wealth-producing enterprises.

The engineer, however, has no fault to find with such works per se. What he objects to is the policy of bringing such projects forward in the false habiliments of economic works, and then expecting him to justify them on the only basis which is humanly possible—namely, tangible, economic values. Furthermore, he has had sufficient practice in handling economic matters to know that, in the end, such undertakings must be considered as luxuries, only to be afforded, no matter what one's social philosophy may be, as the surplus, achieved through the creation of actual wealth, permits such practical manifestations of charity.

In short, a project which has an economic *raison d'être* is within the bailiwick of the engineer, and he is competent and ready to advise on its design and feasibility. Give him a proposal of a social nature, and he can tell you how much it will cost, but he has no magic formula which will prove that public funds should be used for such an enterprise. It is simply a question of political philosophy and of the public's ability and willingness to pay.

In between these two extremes are, of course, other projects which possess both tangible and intangible economic values. This is the field in which we may reasonably expect, in the course of time, some improvement in the effectiveness of economic analysis. Such improvement will come, however, through the reduction of social values to an economic basis for evaluation, and not by any mysterious hocus pocus that the engineer may be expected to develop for justifying a Pollyanna attitude in regard to public works.

Events of recent years have brought into clearer perspective the necessity of relying on sound engineering advice instead of wishful thinking in the formulation of policies involving the expenditure of public funds on engineering enterprises. In the past, the public works policy of the federal government has been based, or at least has been supposed to be based, on economic considerations. Needless to say, many mistakes have been made but, with few exceptions, only works that it was thought would aid in the economic development of the nation have been undertaken. On the other hand, the more recent policy is, apparently, not to wait for economic demand to develop but, in the interests of social as well as economic progress, to anticipate and, presumably, to direct future developments.

Thus, in spite of the fact that the public works policy of earlier days was far from perfect and frequently led to waste and extravagance, we have ventured into the realm of so-called planned economy and social uplift. Such a move obviously involves tremendous uncertainties and hazards—it involves experimenting on a huge scale with greatly increased probability of error and waste.

The engineer, realizing these dangers and difficulties, and jealous of his reputation, would in general advise low speed in an attempt to navigate this new and uncharted sea. Furthermore, he would advise that more effective efforts than ever before be made to separate the soundly economic from the purely social enterprise. He would be the last to deny that if social works are to be built, they should be planned and designed, as far as humanly possible, to furnish the desired service effectively and efficiently. Their justification on economic grounds is, however, not a mere matter of vision or flexible technical capacity—it is beyond the power of man. He refuses, therefore, to accept the responsibility for those undertakings which are purely social, and he feels that it is probably wise to bring up the engineers of the future to keep their feet on the same solid ground which has served for some fifty centuries to support a progressive and useful profession.

ENGINEERS' NOTEBOOK

From everyday experience engineers gather a store of knowledge on which they depend for growth as individuals and as a profession. This department, designed to contain ingenious suggestions and practical data from engineers both young and old, should prove helpful in the solution of many troublesome problems.

Freeboard for Water-Impounding Structures

By FRED H. WOLF

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A LOGICAL method of determining freeboard for reservoirs, which takes into account both the fetch and the maximum wind velocity, is presented here. It was developed by the writer, following a review of technical publications, a theoretical analysis, and an investigation of a number of existing reservoirs.

It appears that very little helpful information on the subject has been published thus far. There are three well-known formulas which help in estimating the height of waves, as explained in the paper by Joel D. Justin, M. Am. Soc. C.E., in TRANSACTIONS, Vol. 87 (1924):

Stevenson's..............	$H = 1.5\sqrt{F} + 2.5 - \sqrt[4]{F}$
Hawksley's..............	$H = 1.95\sqrt{F}$
Henny's.................	$H = 0.075\ (V - 8.5)$

In them

F = fetch, or the maximum clear open-water distance directly upstream from the dam, in miles

V = wind velocity, in miles per hour

H = height of waves above the normal undisturbed water surface, in feet

It will be noted that not one of these formulas includes all three variables. Henny's is the only one that gives consideration to V, and it can be used only when F equals 5, that is, the value at the Belle Fourche Reservoir, the point of observations.

A comparison between the Stevenson and Hawksley formulas, in curve form, is shown in Fig. 1. Points representing observed wave heights for various bodies of water, as given in Mead's *Hydrology*, Table IV, page 106, have also been plotted, and it is interesting to note the close agreement with the curves. Most important, to my mind, is the indication that Hawksley's formula gives values of H which are more on the side of safety, especially when F is 5 or more.

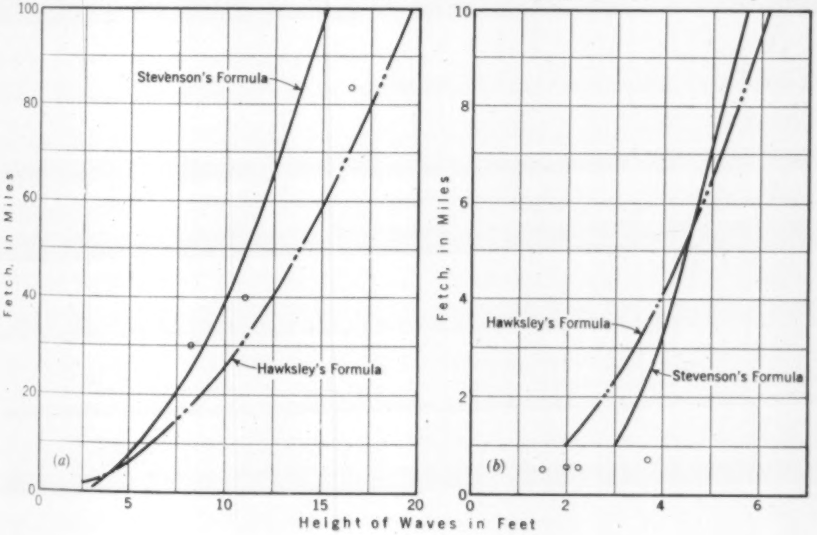

FIG. 1. RELATION OF WAVE HEIGHT TO FETCH
(*a*) Small-Scale Diagram (*b*) Enlarged Portion

Henny's formula, which is based on observations of H for various values of V at the Belle Fourche Reservoir, periodically throughout 1915, is an important contribution. However, it necessarily assumes a fixed value for F. A comparison between observed and computed values of H is shown in Fig. 2.

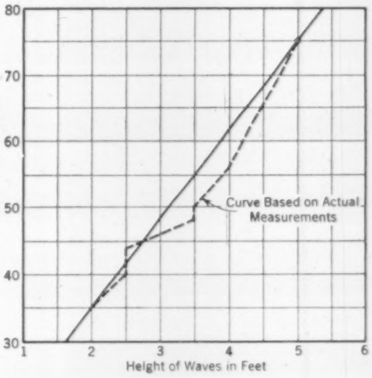

FIG. 2. RELATION OF WAVE HEIGHT TO WIND VELOCITY AT BELLE FOURCHE RESERVOIR

Obviously, we should be interested in some method of estimating H for various values of V and F. Examination of Figs. 1 and 2 indicates that Hawksley's formula and Henny's formula are in close agreement as regards H for $F = 5$ and $V = 66$. Assuming this same relationship for various values of V and F, the following formula may be set up:

$$H = W\sqrt{F} \qquad [1]$$

W may be called the wind velocity factor.

Replacing H by its value from Henny's formula, and substituting 5 for F, we have:

$$0.075\ (V - 8.5) = W\sqrt{5}$$

Whence $W = 0.0335V - 0.28$, and Eq. 1 becomes

$$H = (0.0335V - 0.28)\sqrt{F} \qquad [2]$$

From Fig. 3, which is based on Eq. 2, values of H may be read directly for any simultaneous values of F and V.

It is to be regretted that so few observations of wave height have been recorded at reservoirs with a wide range of values for V and F. However, in the absence of more complete records and experiments, I would suggest that this modification of an existing formula be used for almost any water-impounding structure. Of course, in certain parts of the country, some thought should be given to an allowance for other disturbing factors—as, for example, earth tremors.

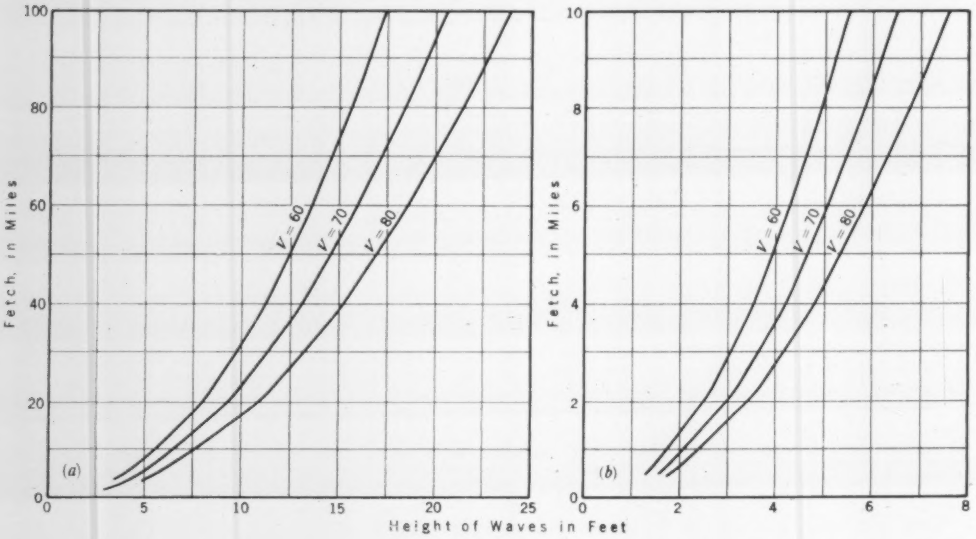

FIG. 3. RELATION OF WAVE HEIGHT TO FETCH AND WIND VELOCITY
(*a*) Small-Scale Diagram (*b*) Enlarged Portion

Having adopted a reasonable method for estimating *H*, it is of interest to see what may be derived from examining an assortment of existing successful developments. Some fifty well-known earth and rock-fill structures were investigated, primarily for the purpose of ascertaining a safe allowance for "ride-up and wind spray"—that is, the vertical distance from top of wave to top of dam. In each case the total freeboard—the distance from the maximum flood-water surface to the top of the dam or parapet wall—was determined. Theoretical wave heights were then computed, using the curves in Fig. 3, and deducted from the figures for freeboard. The results are summarized in Table I. Naturally the figures given in this table, based on projects which have proved to be successful, can be considered only as apparent allowances and should serve simply as a guide when making computations for some new development. Obviously, in the absence of observations and experiments, an engineer should use his better judgment, and these figures will help.

TABLE I. HEIGHT ABOVE THEORETICAL TOP OF WAVE TO TOP OF DAM OR PARAPET WALL, IN FEET

	$V = 60$	$V = 70$	$V = 80$
Average	5.35	4.42	3.40
Maximum	10.00	8.45	7.40
Minimum	1.25	1.00	0.50

A number of sizable concrete dams were also investigated. The corresponding figures were somewhat less than for earth dams, and this is as it should be. However, the difference was only a little over one foot in general. I expected to find a greater decrease, especially in the average apparent allowance, as it is a fact that waves do not ride up the vertical face of a concrete dam so far as they do the sloping face of an earth or rock-fill structure. Moreover, a little "ride-up water" and wind spray should not ruin a well-built concrete structure.

It may be concluded that, lacking a more definite method, the most logical way to determine the proper freeboard allowance for a new dam is to estimate the highest waves above maximum flood-water surface, using the modified formula developed here, and add a substantial amount for ride-up and wind spray. For example, assume a fetch of 10 miles and a maximum wind velocity of 70 miles per hr. Under these conditions, what is a reasonable freeboard allowance for an earth dam? From Fig. 3, the wave height is 6.5 ft. From Table I, the average apparent allowance for ride-up and wind spray is 4.5 ft. Hence the total freeboard for the earth structure is 11.0 ft.

It should be noted that the theoretical height of waves is truly the vertical distance from trough to crest. In this discussion, however, height refers to vertical distance above normal undisturbed water surface.

A System for Filing Technical Literature

By E. W. LANE, M. AM. SOC. C.E.
PROFESSOR OF HYDRAULIC ENGINEERING, UNIVERSITY OF IOWA, IOWA CITY, IOWA

A VAST amount of valuable technical information can easily be collected from the technical press and other sources, but to store this material so that the articles dealing with a particular subject can be readily found requires careful planning. There are two methods that can be used, and each has certain advantages.

The more common method is to bind the volumes, and use one's memory, the volume indexes, or the annual index to find the desired article. A card file of the most valuable articles is an improvement over the printed indexes, but takes a good deal of time to prepare if many cross references are included. This method applies particularly to technical periodicals. It has the advantage of saving all the material, but the cost of binding is high, and for engineers who frequently move their headquarters the cost of freight for more than a few volumes is a large item, as I have learned from sad experience. Furthermore, bound volumes cannot be readily carried out of the office, and when a number of articles are to be looked up at one time, the result is a bulky pile of books which is inconvenient to handle.

The second method is to clip selected articles and file them by subject. The system I have evolved for this work is so satisfactory that I believe others may be considerably helped by adopting it. It consists essentially of working out a scheme of classification covering the subjects on which one desires to collect data, and assigning a key symbol—either a letter or a number—to each class. Each article in the technical magazines which is deemed worthy of saving is marked with the proper key symbol. The marked articles are then removed from the magazines as whole sheets, no clipping with shears being done. They are stored in a vertical file or suitable box provided with a folder for each classification. If more than one article appears on the same sheet, or if it is desired to cross reference an article under more than one subject, the material is filed in a "conflict and cross-reference" folder with a special index sheet which enables it to be readily found under any of the subjects to which it may refer.

THE CLASSIFICATION SYSTEM

The classification system to be used depends upon the field which it is desired to cover. It should include all the topics in that field and all those reasonably closely related, but should not attempt to cover too great a range or a point will be reached where the labor and bulk involved in handling the less desirable items will not be justified. For my personal use I have developed a classification that covers practically the whole range of hydraulic engineering:

A. Agricultural drainage, alkali troubles
B. Books, bibliographies
C. Cement, concrete
D. Dams
E. Earth mechanics
F. Floods and flood control
G. Gates, valves
H. Hydraulics, silt
I. Irrigation
J. Miscellaneous constructions (piles, retaining walls, etc.)
K. Cost data
L. Legal, economics, ethics
M. Materials (properties, strength, etc.)
N. Navigation improvements, bank protection, locks
O. Office practice, surveying, mapping, etc.
P. Pumps and pumping
Q. Channels, pipes
R. Rainfall, runoff, return water
S. Sewage, sewers, and sewage disposal
T. Turbines
U. Underground explorations, underground water, geology
V. Water works
W. Water power, hydroelectric plants
X. Excavation, tunneling, earth moving
Y. Mathematics, mechanics
Z. Miscellaneous, transportation

It will aid in remembering the classification if each key letter is the initial one of the subject to which it refers. If the range of subjects is too large to be readily covered by the alphabet, numbers can be used, or the Dewey decimal system might be adopted. However, I have not found the latter well adapted to my work.

It is an advantage not to have too many primary classifications, as it simplifies the cross reference sheet. A good way to make up a classification suitable for the individual is to get together all the magazines on hand for several years back, take out the articles desired, and from them work out the grouping system that will file them in the most logical manner. Unless this is done one is apt to find that a number of really important subjects have been overlooked and the best possible arrangement of others has not been secured.

After the main classifications are determined upon, the subdivisions can be worked out. Unless one has collected a great deal of material, however, extensive subdivision is not justified. It is surprising how much material can be handled efficiently without subdivisions; and the more material one has before working out the sub-classes the more satisfactory they are likely to be. When the main divisions are indicated by letters, the subdivisions are numbered, and vice versa. Under dams, for example, D-1 would be general articles, D-2 earth dams, D-3 rock-fill dams, and D-4 masonary dams. The first subdivision under each class should be a general one to include articles concerning the general topic and those that properly belong under none of the subdivisions or under more than one of them. It will be advantageous to work out the subdivisions in the same way that has been suggested for the main divisions.

There are always a number of subjects that might be placed in sub-classes under a number of different topics. In hydraulics, silt is one of these subjects. It comes up in connection with dams, reservoirs, ditches, and rivers, and might be classified under all of them, but to do so would scatter through the file material that really is closely related. With the alphabetical system there would be too few letters to make this sort of subject a separate class. It might be done where numbers are used, but it is desirable to keep down the number of main classes. Therefore, all material on silt is more or less arbitrarily placed under some one of the main subjects where it could logically belong. To avoid confusion, a small notebook is provided, with the doubtful subjects listed alphabetically with their classification. When a doubtful subject is first found, a decision is made regarding its classification and this is entered in the book. When other articles on this subject are encountered, the book will indicate how they should be filed.

The same classification can be used for pamphlets, miscellaneous reports, blueprints, and other engineering data, as for articles cut from technical periodicals. It is often convenient, if one does not have a copy of an article he desires to keep, to file instead a sheet of paper giving a reference to the publication in which it can be found. Pamphlets are difficult to file in vertical files or boxes, and I have found shelves to be more satisfactory for material of this type. Miscellaneous data can be filed in a vertical file, either along with the magazine articles or in a separate series.

This type of filing system should not be adopted until an engineer has settled into one general field of work. The young engineer should save his magazines complete, perhaps in temporary binders. By the time he has begun to specialize, he will have enough material for a valuable file.

CLASSIFYING AND FILING

The first step in classifying and filing data is to mark it with its key letter. It will be an advantage to place the symbol where it will appear in an upper corner when filed. After the classification system is established, this is the only operation which must be performed by an engineer; the rest can be done by an intelligent stenographer or office boy. Two evenings a year are sufficient to mark all the data an engineer is likely to want from a large weekly publication dealing especially with his own field.

For the magazine containing much data it is easier to remove the staples and tear out the sheets with a paper knife than to use shears. Whole sheets only should be removed, as clippings are difficult to handle in a file. If a single article covers two or more sheets, the sheets should be fastened together with some kind of stapling device; paper clips are not satisfactory. The sheets should be arranged with the first page of the article on top, so that the title can be seen, even though this may mean that the back of the first sheet is not a part of the article.

CROSS REFERENCING

One of the most difficult things to handle in a filing system for technical literature is cross referencing. Some articles cover more than one subject, and there are also conflicts if articles on opposite sides of the same sheet belong under different classifications. Both of these cases are handled in the same manner. The clippings are given file numbers and placed in a separate file in numerical order. It is advantageous to arrange them chronologically, with the year forming the first two numbers; for example, 0925 would be the twenty-fifth article of 1909. A cross-reference sheet is then made out with a column for each major classification and the file number of each article in order along the left edge of the sheet. Opposite the number of each clipping a check mark is placed in each column corresponding to the subjects covered in that clipping. For example, if clipping 0925 contained material on concrete, dams, and floods, the line numbered 0925 would show check marks in the C, D, and F columns. If there are subdivisions to the main classifications, the subdivision symbol is entered in the proper column instead of a check mark. If there are no subdivisions, it will be advantageous to have a space for remarks at the right side of the index sheet and to note there briefly the subject of the article. In this manner an article may be very easily cross referenced under as many subjects as desired.

ADVANTAGES OF THE FILING SYSTEM

One of the advantages of this method of filing is the ease with which expansions and reclassifications can be made. Suppose the material accumulated under one of the major classifications becomes too bulky and it is desired to subdivide it. The clippings in the folders are separated according to the various subdivisions which it is advisable to make. All the numbered articles shown under that classification on the cross-reference sheet are removed from the file and similarly classified. Then opposite the number of each on the cross-reference sheet the proper subdivision symbol is entered in place of the check. These operations require very little time, and when they are performed all the articles and all the cross references are changed over to the new system. If it is desired to reclassify any of the clippings, they are simply transferred into the folder of material on their new classification or, if they are in the cross-reference class, the check mark on the cross-reference sheet is changed in accordance with the new classification.

Another advantage of this sytem, as compared with bound volumes, is that the material on any subject is easily portable. A prominent engineer who has a similar system takes the data on his problems with him on his trips, and when he arrives at his destination he is thoroughly posted on the latest developments in the field under consideration.

But perhaps the greatest advantage of a file of this sort is that it will be used. With a set of bound volumes one might look up all the information available on a particular subject, but when the problem actually arises the necessary time is rarely available. Moreover, cases frequently come up which do not justify an extensive search but which make it amply worth while to go through a few folders to get the most recent information. The best way to progress in engineering is not to work out things from the bottom, but to learn first what others have already found out.

Solving Equations by Means of an Equivalent Parabola

By FREDERICK SHAPIRO, JUN. AM. SOC. C.E.
RODMAN, OFFICE OF BOROUGH PRESIDENT OF MANHATTAN, NEW YORK, N.Y.

SEVERAL methods of successive approximation are available for solving complicated equations in one variable. If the equation is purely algebraic, Horner's method may be applied. In this system of root-seeking, the first significant figure of the root is found in the preliminary trial, and the polynomial function is then adjusted to enable the computation of the second significant figure to be made. This process is repeated for each additional significant figure required. In solving trigonometric and exponential equations, the method of Newton has been found useful. To apply it, it is first necessary to determine in some manner an approximate value of the root. Then, at that point, the original function is replaced by the tangent to the curve it represents. The intersection of this tangent with the coordinate axis is taken as a better approximation to the value of the root than the first assumption. By repeating this procedure over and over again, it is generally possible to obtain the solution to the desired number of figures.

Both these methods have many disadvantages. They are long and tedious. Horner's method holds only for algebraic equations, and Newton's fails to give good results in many cases where the first or second derivative of the function changes sign between the assumed and actual values of the root. Moreover, Newton's method often converges very slowly.

I have obtained excellent results by using a tangent curve, rather than the tangent line of Newton's method. The curve most easily handled is the parabola, and its proper shape may be secured by giving it the same value of ordinate and of first and second derivatives as the original function at the approximate value of the root. A formula may easily be derived from these assumptions. However, a more concise method of developing it is as follows:

Suppose $f(x) = 0$ is the original equation, and x_1 the approximate solution. Then, $f(x_1)$, $f'(x_1)$, and $f''(x_1)$ are, respectively, the ordinate, first derivative, and second derivative of $f(x)$ at x_1. If x_0 is the exact value of the root, the Taylor expansion for $f(x)$ is

$$0 = f(x_1) + f'(x_1)(x_0 - x_1) + {}^1/_2 f''(x_1)(x_0 - x_1)^2 + \dots$$

Neglecting powers of $x_0 - x_1$ greater than the second, solving for $x_0 - x_1$, and transposing,

$$x_0 = x_1 - \frac{f'(x_1)}{f''(x_1)} \pm \sqrt{\left[\frac{f'(x_1)}{f''(x_1)}\right]^2 - 2\,\frac{f(x_1)}{f''(x_1)}}, \text{ approximately.}$$

Then, if x_2 is a second approximation to x_0, the formula becomes

$$x_2 = x_1 - \frac{f'(x_1)}{f''(x_1)} \pm \sqrt{\left[\frac{f'(x_1)}{f''(x_1)}\right]^2 - 2\,\frac{f(x_1)}{f''(x_1)}} \dots [1]$$

The proper sign to precede the radical may be chosen at the discretion of the computor. Using x_2 and substituting in the formula should give an even better approximation to the required root.

This method is applicable to algebraic, trigonometric, exponential, and logarithmic equations. Two examples will be given:

Example 1: $f(x) = 2x^3 - 9x^2 + 12x - 5 = 0$
$f'(x) = 6x^2 - 18x + 12$
$f''(x) = 12x - 18$

Try $x_1 = 2.0000$. Then $f(x_1) = -1.0000, f'(x_1) = 0$, and $f''(x_1) = 6.0000$. Substituting in Eq. 1,

$$x_2 = 2.0000 - 0 + \sqrt{0 + 2 \times {}^1/_6} = 2.5774$$

As a second approximation, try $x_1 = 2.5800$. Then $f(x_1) = 0.3994$, $f'(x_1) = 5.4984$, and $f''(x_1) = 12.9600$. Substituting as before, $x_2 = 2.4998$. The correct answer is 2.5000.

$$\text{Example 2:}\; \begin{aligned} f(x) &= x + \sin x - 2.0158 = 0 \\ f'(x) &= 1 + \cos x \\ f''(x) &= -\sin x \end{aligned}$$

Try $x_1 = 1.0000$. Then $f(x_1) = -0.1743$, $f'(x_1) = 1.5404$, and $f''(x_1) = -0.8415$. Substituting in Eq. 1,

$$x_2 = 1.0000 + 1.8305 - \sqrt{3.3509 - 0.4142} = 1.1168.$$

The correct answer is 1.1170.

Our Readers Say—

In Comment on Papers, Society Affairs, and Related Professional Interests

Construction of Piers for Yaquina and Coos Bay Bridges

To the Editor: The article by G. S. Paxson, Assoc. M. Am. Soc. C.E., in the October issue, covers the major construction problems of the Oregon Coast Highway bridges in a most satisfactory manner. I shall comment on a few of the lesser problems that may be of interest to engineers and contractors. Some difficulties were met in the construction of Piers 2 and 3 of the Yaquina Bay Bridge. These piers for the 600-ft arch span over the main channel were the controlling factor in the completion of the bridge on time.

Pier 2, at the north end of the arch span, rests on a soft rock formation with its base 50 ft below the water. The design contemplated the construction of this pier in the dry without the use of a concrete seal inside the cofferdam. The area of the cofferdam was first drilled and blasted. Then a steel sheet cofferdam was driven through this blasted material into the rock formation to a point about 6 ft below the bottom of the pier. The cofferdam was excavated to the full required depth and unwatered to within 2 ft of the bottom when a large "blow" at the southeast corner flooded it. It was then decided to pour a seal for the entire area of the cofferdam and construct the pier on top of this seal.

Pier 3 at the south end of the 600-ft arch, begun in September 1934, was not completed until October 1935. This delay was due to unforeseen foundation difficulties. The pier rests on timber piling driven into the sand and gravel formation to El. −80. A steel sheet cofferdam was driven 6 ft below the proposed base of the pier. This had been excavated to about El. −48 when it was found that the sand was running in from the outside as fast as it was excavated. After considerable delay it was decided to raise the base of the pier to El. −48, whereupon the foundation piles were driven, a seal poured, and the pier constructed in the dry. The steel cofferdam was cut off near the bed of the bay and left in place as a precaution against scour.

At Coos Bay and Yaquina Bay, the steel contractor, F. H. Holser and Company of Los Angeles, developed a very simple and economical method of erecting the steel spans. Although at times there was a shortage of skilled bridge men, the work went on with clocklike precision, even in the face of adverse weather conditions. The steel arch at Yaquina Bay Bridge was pushed out from either side, suspended by only four $2^1/_4$-in. cables, until the arch met 246 ft above the water.

In no type of construction is the question of equipment of more importance than bridge work. One of the contractor's major problems is to decide on the amount of money he may tie up in equipment in order to complete the job within the time specified and still make a profit. Compare, for instance, the equipment used in the construction of the Yaquina Bay and the Coos Bay bridges. In each contract there is a bonus of $50 per day and a liquidated damage of $100 per day, from the completion date, which in each case, was two years after work was ordered to start.

The Coos Bay Bridge cost 34 per cent more than the Yaquina Bay Bridge. The former was highly equipped in every department of the work. There were two central concrete mixing plants of modern type, four large gantry cranes, costing at least $5,000 each, 13 donkey engines, and 14 large pumps. At the Yaquina Bay Bridge, on the other hand, there was but one concrete mixing plant located on a barge, one gantry crane similar to the one at Coos Bay, seven donkey engines, and five large pumps, which were rented as needed. The Coos Bay contractor will have a small bonus for completion before time, and the Yaquina Bay contractor may have to pay a small amount for liquidated damages. However, this will be very little compared to the saving on equipment.

M. E. Reed, M. Am. Soc. C.E.
Resident Engineer Inspector, PWA

Newport, Ore.
October 30, 1936

High Unit Stresses Justified in Oregon Coast Bridge Design

To the Editor: In connection with O. A. Chase's article on "Design of Coast Highway Bridges," in the October issue, I should like to comment on these five structures. When all these bridges on the Oregon Coast Highway are open to traffic, the driving time required for the 3-mile total length of bridges will be one hour less than is required by the five ferries that have heretofore been in operation.

A traffic survey conducted by the U. S. Bureau of Public Roads in 1929 and 1930, together with available studies and forecasts, formed the basis on which the financial setup of the bridge projects was made in 1934. Originally it was intended to operate the bridges with a low toll until construction bonds had been paid off. However, later developments, with a large traffic increase, induced the state highway commission to abandon the tolls, and all bridges are to be operated free.

Since these bridges were to be constructed as PWA projects, the time element in design and preparation of plans and contract papers was of major importance. It was necessary for the state bridge engineer to increase personnel, and qualified designers, detailers, and draftsmen who were locally available were employed. Most of the designs and details were made by two shifts of engineers working at top speed, and designs and details were checked in the local office of the U. S. Bureau of Public Roads, where additional engineers were also required.

The Pacific northwest area is fortunate in having available high-grade and relatively cheap glacial sand and gravel aggregates of all sizes required for different classes of concrete mixes. The quality and uniformity of these aggregates permit the use of high unit stresses in the design of roadway slabs and other sections of superstructures where a saving in dead load is reflected in a further saving in net sections of trusses and arches.

Without extra precautions or increasing cement content above that of normal mixes, concrete strengths between 4,000 and 5,000 lb per sq in. are readily obtained in 28 days.

The unit compressive stress used with 4,000-lb concrete for slab design was 1,000 lb per sq in., and for arch rib design, 1,200 lb per sq in., including impact, wind, rib shortening, and temperature effects. For the Considère hinges the unit stress was 2,000 lb for 5,000-lb concrete.

A local timber known as Port Orford cedar is also of economic value in bridge construction in Oregon. This timber is close-grained, light in color, and light in weight, the weight at 12 per cent moisture content being 29 lb per cu ft as against 41 lb per cu ft for coast Douglas fir. The strength is only from 5 to 10 per cent less than that of fir, and the shrinkage is less than that for fir. The life under unfavorable soil and moisture conditions is about three times the life of fir or of long-leaf pine, and various wood-destroying organisms, such as ants, termites, and teredos, do not act on this cedar.

This light-weight cedar was economically adapted for use on the deck of the bascule span over the Siuslaw River. Because of its long life it was used for all piling exposed to air or sea water, except for the Coos Bay Bridge, where as an experimental project, a relatively new process was used on coast Douglas fir piles for fenders and dolphins. This process, known as "mineralized cell treatment," consists of forcing under pressure a chemical solution of preservative and toxic salts through the entire length of the logs from the butt ends, thus saturating the sapwood and a small portion of the heartwood. This process is simple, and the treatment can be readily performed at the place where the timber is cut or used, thus eliminating extra transportation costs.

Each of the five structures has a spectacular setting and can be seen at many angles from adjacent land, as well as waterways. These numerous viewpoints furnish adequate opportunity to appreciate the architectural treatment.

RENE B. WRIGHT, M. Am. Soc. C.E.
Senior Highway Bridge Engineer,
U. S. Bureau of Public Roads

Portland, Ore.
November 1, 1936

Construction Problems at Bonneville Dam

TO THE EDITOR: Some side lights on the subject treated by C. I. Grimm, M. Am. Soc. C.E., in his article on "Construction Methods at Bonneville," in the October issue, may be of interest. Among the difficulties encountered was the fact that the river bed was strewn with boulders from 5 to 30 ft in diameter. Lead line soundings proved inaccurate by from 5 to 10 ft, and failed to disclose the size and shape of the boulders.

SOUNDING BARGE AT BONNEVILLE DAM

A 32 by 80-ft steel barge was rigged up with a head frame to steady four sounding rods of 3-in. extra heavy pipe on 4-ft centers. These rods were operated by a three-drum hoist, and to prevent bending in the current, which had a velocity of 10 ft per sec, they were housed in 6-in. heavy pipe casings, extending to within 10 ft of the bottom and anchored upstream to the barge with a stay line. This sounding barge is shown in the accompanying photograph. A second three-drum hoist controlled the anchor lines, and the barge could be spotted very accurately and quickly to a tag line across the river on coordinate points. The base of a 60 by 60-ft crib could be sounded on 4-ft centers each way in one day with a crew of 10 men. As many as 300 soundings have been made in one 8-hr shift. When boulders were encountered, the soundings were taken at 2-ft centers. Soundings were read by this rod method to tenths of a foot in 60 ft of water, and check soundings always showed a high degree of accuracy.

Of the 21 cribs placed in the south cofferdam, 15 had interlocking steel sheet-piling protection. This was driven 3 ft into bedrock except where the gravel and boulder overburden exceeded 20 ft in depth. Six cribs nearest the shore had no steel sheet piling at all, but depended largely upon impervious fill against them and a blanket on the river bed for imperviousness. When the 8-acre cofferdam was unwatered, the pumping reached 100 cu ft per sec, but impervious material was dumped over the edge and helped seal the interlocking sheet piling.

As the water level within the cofferdam area was lowered, the outside pressure forced the tops of the cribs inward, thus further tightening the cofferdam and reducing the pumping. When the coffer was empty, the tops of the cribs were deflected inward about 18 in. and, being non-elastic, took a permanent set there. Pumping fell off rapidly to about 30 cu ft per sec, and at the minimum stage of river level it was as low as 17 cu ft per sec for several weeks.

More serious difficulties were encountered with the north coffer. The spring flood came suddenly about a month early and prevented seating 4 cribs of the downstream leg. Closure of the upper leg was barely affected with pulls of 1,500,000 lb per crib, but time did not permit driving sheet piling along the two closing cribs 28 and 28A. These two cribs were imperfectly seated, and about 10,000 cu ft per sec was passing under and between them.

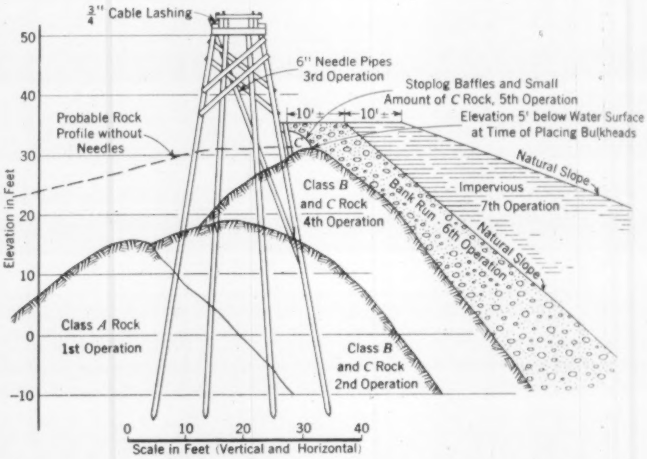
$\frac{3}{4}$" Cable Lashing
6" Needle Pipes 3rd Operation
Stoplog Baffles and Small Amount of *C* Rock, 5th Operation
Elevation 5' below Water Surface at Time of Placing Bulkheads
10' ±
10' ±
Probable Rock Profile without Needles
C
Natural Slope
Class *B* and *C* Rock 4th Operation
Bank Run 6th Operation
Impervious 7th Operation
Natural Slope
Class *A* Rock 1st Operation
Class *B* and *C* Rock 2nd Operation
Elevation in Feet
50
40
30
20
10
0
−10
0
10
20
30
40
Scale in Feet (Vertical and Horizontal)

FIG. 1. TYPICAL CROSS-SECTION OF ROCK CUTOFF

Cribs 28 and 28A were not vertical, and to eliminate the necessity of using taper sheet piling and to give better bearing for the steel sheet piling near the river bed it was decided to construct special wedge-shaped cribs with 20 cu yd of concrete in the points. These cribs would not only serve the aforementioned purposes but would also close the opening under the cribs. They were built on a slightly inclined platform on top of the old cribs. The concrete end projected out a sufficient distance to practically balance the rest of the crib, so a very light lift was required to launch them overboard into position.

An earth fill heavily protected with riprap comprised the shoreward 120 ft of each leg of the cofferdam. At peak flood the upper leg was overtopped, and the head differential of 8 ft washed out the rock-protected shore fill in a few hours. Heavy jetty rock was dumped to protect the shore from scour, and the gap was closed by driving a pile trestle and dumping jetty rock from the downstream side, smaller rock above, and finally gravel and an impervious clay blanket for watertightness (Fig. 1).

An interesting feature of this rock closure was the use of 6-in. pipes for needles between bents, and timber bulkheads for the upper 5 ft. These measures resulted in a material saving in rock.

Several stress meters were buried in the rock under the main dam, and at various locations in the dam itself, to determine horizontal, vertical, and inclined stresses. Thermometers, used in three blocks of the dam, indicated that the temperature rise averaged from 30 to 38 F, with the maximum in 5 to 30 days, depending on cover.

B. E. Torpen, M. Am. Soc. C.E.
Senior Engineer, Corps of Engineers, U. S. Army

Bonneville, Ore.
October 17, 1936

Improving the Channel of the Columbia

To the Editor: I should like to comment on the article by Col. Thomas M. Robins on "Improving the Columbia for Navigation" in the October number. The first project for improving the river channel allowed for a depth of 20 ft. This was successively modified to provide depths of 25, 30, and finally 35 ft. Some dikes were constructed in the river in the early days, but the channel was maintained principally by dredging. Reliance on dredging alone was not satisfactory, however, and the construction of modern contraction works was started in 1916 and continued to 1934.

To determine the amount of contraction necessary to maintain the channel depth desired, examination was made of old charts of the river in its original condition. As many points as possible were found where channel depths were satisfactory, and at these the widths between banks were measured. These measured widths were then plotted against the distance along the channel, and a curve was passed through the points. From this curve the proper width between banks required to maintain the desired channel depth at any point is found by inspection.

Permeable dikes constructed to the channel lines thus determined do not immediately produce the constriction desired, but as dredging of the channel progresses and spoil banks are built up between the dikes, a permanent and stable channel is produced. The aim has been to use the dikes to maintain, rather than to create, channel depths. Otherwise, the regimen of the stream is too violently disturbed and large quantities of material are set in motion.

It is believed, also, that more satisfactory results can be obtained by placing the ends of dikes as near to the channel to be maintained as the requirements of navigation will admit. This, in some situations involves the construction of detached dikes and the building up of middle grounds between two channels.

Most of the dikes as constructed consist of two rows of piles driven in a staggered arrangement, with the piles spaced from $3^1/_2$ to 5 ft between centers in each row, and with a riprap protection on the bottom. By constructing the dikes to an elevation of only half the freshet stage, provision is made for passing the flood waters without causing excessive velocities or scour.

Where the dikes are used primarily for bank protection (not generally the case), they are spaced about 800 to 1,000 ft apart, the more open type of construction is used, and the cutoff elevation is a little below the top of the bank. Contraction dikes are spaced from 1,800 to 2,500 ft apart, the narrower spacing being used on the concave side of bends.

As a result of the combined work of dredging and dike construction the channel has been stabilized and now shoals to only a limited extent. Twenty years ago some of the bars would shoal during freshets to minimum depths of 17 to 20 ft, whereas the minimum depth now at any point is rarely less than 30 ft. Furthermore, although channel depths and widths have been greatly increased from time to time, the amount of dredging necessary annually has steadily decreased.

In undertaking works of improvement in any river, it should be realized that each stream is a problem in itself. Streams may appear to have the same characteristics, but there are probably many hidden differences which will affect the problem of improvement. Plans and methods that are entirely practical and successful for one stream might not be applicable at all to another apparently similar.

Robert E. Hickson, M. Am. Soc. C.E.
Principal Engineer, U. S. Engineer Department

Portland, Ore.
October 22, 1936

Need for Water Storage in the Willamette Valley

To the Editor: In the October number George E. Goodwin, M. Am. Soc. C.E., has presented an excellent paper on the subject of irrigation in western Oregon and Washington. The major part of the land irrigated in western Oregon is located in the Rogue River valley, where it appears that irrigation was practiced as early as 1862. Within the Willamette Valley, it has been practiced to a limited extent for many years. However, for various reasons, irrigation development there has been slow, and now is confined chiefly to small scattered tracts.

The principal tributaries of the Willamette River on the west, which have their sources on the east side of the coast range, have high discharges during the rainy season, although during the summer months the runoff is very small and the low-water flow is now largely appropriated. The principal tributaries on the east have their sources in the Cascade range where the melting snow tends to maintain the summer flow, and these streams provide practically all the water flowing into the Willamette River at Salem, Ore., during the summer months.

Since the Willamette is a navigable stream, the government's paramount interest in navigation must be considered in the planning of any new, sizable irrigation project.

For the period 1878 to 1930, the record of the flow of water in the Willamette River at Albany, Ore., shows that the mean monthly flow for August was 3,440 cu ft per sec and for September 3,450 cu ft per sec. The low-flow probability curve of the Willamette River at Salem indicates an average minimum low-water flow of approximately 3,500 cu ft per sec.

Of the various rights that have been initiated for the appropriation of the waters of the Willamette River and its tributaries, I will quote from the report of the U. S. Army Engineers on the Willamette River in Oregon. Under the provisions of House Document No. 308, this report stated: "It is believed that other uses, including irrigation, important as it is, should not encroach upon the low flow of the Willamette River when the discharge at Salem is 3,500 cu ft per sec or less."

The floods or high-water stages in the Willamette River, caused by the direct runoff of winter rains in the watershed of the main stream and its tributaries, ordinarily occur during the period from November to March, with an occasional short freshet in the spring, due to the melting snows in the Cascade range. Since these floods are of short duration and the high-water periods on the different tributaries usually do not occur at the same time, general floods are rare. These conditions render the installation of storage reservoirs the most practical method of flood control and protection from damage by floods.

There are many sites on the headwaters of the main tributaries of the Willamette River, suitable for the construction of reservoirs, which could be used not only to store water for irrigation but also to control floods, to develop power, and to aid navigation.

Studies made by the U. S. Army Engineers indicate that, with a flood-crest height of 20 ft at Salem, an area of 420 sq miles above Salem is flooded; and records show that floods having a crest height of 20 ft or over have occurred at intervals of from one to four years, the average interval for the period from 1892 to 1930 being two years. Some of the most fertile land in the Willamette Valley lies in this area.

As stated by Mr. Goodwin, the construction of storage reservoirs to provide water for irrigation purposes alone would be expensive. However, by designing and constructing these reservoirs to serve other purposes, the cost chargeable to irrigation will be materially reduced. Considering the fact that the development can be made in units and that it will be feasible to utilize the reservoirs for flood control and other purposes, it is my opinion that the Willamette Valley—with its fertile soil, mild climate, and abundance of water that can be made available by storage—presents one of the most attractive irrigation projects in the West as well as one of the most feasible.

Charles E. Stricklin
State Engineer

Salem, Ore.
November 6, 1936

In Favor of "Boulder" Dam

TO THE EDITOR: I should like to join the discussion concerning the correct name for Boulder Dam, which has appeared from time to time in CIVIL ENGINEERING. Years ago the question of constructing a huge dam in a canyon of the Colorado River was considered, and the project came to be known as Boulder Dam on account of the suggested location.

With operations under way, a loyal member of the then president's cabinet renamed the project Hoover Dam in honor of his chief. Since then the work has been completed, and much confusion between the two names has been ended by restoration of the original and more familiar title.

Let scattered irreconcilables be content, put aside their creditable loyalty to the former president, and accept the original, official, and commonly adopted title, Boulder Dam.

A. S. MACGREGOR, M. Am. Soc. C.E.
Engineer of Building Construction
State Department of Public Works

Albion, N. Y.
October 20, 1936

Design of Castelmoron Bridge

TO THE EDITOR: In my article on "European Practice in Reinforced Concrete," in the September issue, Freyssinet is mentioned as the designer of the Castelmoron Bridge. This is an error. The bridge was entirely designed and constructed by the French firm, Établissements Christiani and Nielsen.

DAVID C. WILLIAMS
Department of Mechanics
Ohio State University

Columbus, Ohio
October 21, 1936

Composition of Fort Peck Fill

TO THE EDITOR: In his article on "Placing Hydraulic Fill at Fort Peck," in the October issue of CIVIL ENGINEERING, T. B. Larkin, M. Am. Soc. C.E., has presented the important features of construction. I believe that certain details of this work may also be of interest.

During normal stages, when the river carries a high content of calcium salts, the fines are deposited in the core in a flocculated state, resulting in a viscous suspension of clay and silt particles. The pool ranges from clear water at the surface to a partly consolidated material having approximately 70 per cent voids at a depth of 15 ft. This does not occur during high stages when the river contains a high percentage of sodium salts. Relatively high surface velocities occur in the core pool because of the high viscosity of the flocculated material. Thus sands and silts are carried over and filter down through the flocculated suspension to form a satisfactory core. This action undoubtedly occurs in all hydraulic fill cores where the fines are deposited in a flocculated state. If the fines should remain dispersed and settle as individual particles, it would be more difficult to obtain a core with a high clay content (20 to 40 per cent), since the rate of deposition would be so slow that most of the fines would be wasted over the spillways.

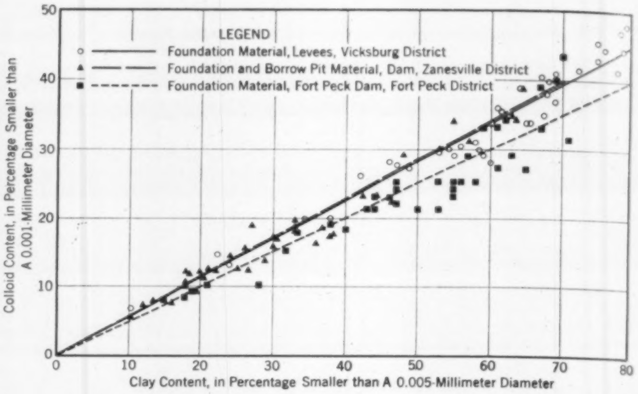

FIG. 2. COMPARISON OF COLLOID AND TOTAL CLAY CONTENT OF VARIOUS SOILS

Consolidation of the core material, which has an average of 20 per cent clay, is proceeding at a satisfactory rate. This increase in density is not due entirely to consolidation, but in the upper part it appears to be the result of the change in mechanical composition, as described by Colonel Larkin. In the firm, partly consolidated core material, the increase in density is due purely to loss of water from the voids of the material. The rate and amount of consolidation to be expected in the core after the dam is completed are estimated from consolidation tests in the laboratory and field data obtained during construction.

Control of the shell, although relatively simple, is just as important, since its stability and permeability are involved. The section of the best portion of the borrow pits and the depth of cut limit the amount of clay placed in the shells. Proper regulation of the core pools, by narrowing to minimum limits at least once each lift, prevents excessive fines from remaining in the shell.

Test results of the samples taken from the core and shell showing effective size and clay content are plotted on a cross-section of the dam, and contours are drawn from them. In this manner, a close check is kept on the permeability, as represented by the effective size, and on the stability, as indicated by the clay content (Fig. 1).

The amount and rate of consolidation are estimated from laboratory tests. I believe that, by comparing the actual settlement during construction, as measured by the subsidence plates, with the estimated settlement, a reasonably accurate prediction can be made as to the rate and amount of future subsidence. The use of only laboratory tests for estimating the amount and rate of consolidation can lead to entirely erroneous results, unless the compressible strata are uniform throughout and the drainage strata definitely located.

It has been found that the colloidal content of most soils varies within practical limits as a straight-line relation with the clay content, as shown in Fig. 2. By running the mechanical analyses only long enough to determine the clay content (smaller than 0.005 mm), determination of the colloidal content is not considered necessary. Thus considerable time in the laboratory is saved.

T. A. MIDDLEBROOKS, Assoc. M. Am. Soc. C.E.
Engineer, U. S. Engineer Corps

Fort Peck, Mont.
October 26, 1936

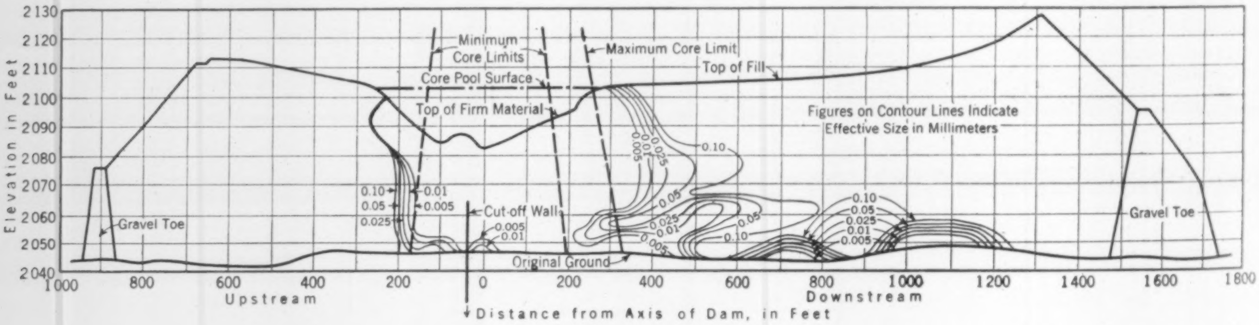

FIG. 1. TYPICAL CROSS-SECTION OF EXISTING FILL, SHOWING EFFECTIVE SIZE OF MATERIAL

Protecting Tacoma's Water Supply

To the Editor: In many respects the general physical characteristics of the Bull Run watershed (described by Ben S. Morrow, Assoc. M. Am. Soc. C.E., in his article on protecting Portland's water supply, in the October issue) are similar to those in the Green River watershed, from which the city of Tacoma, Wash., obtains most of its water supply.

When Tacoma completed the Green River gravity water system in the early part of 1913, there were approximately 1,800 people in the watershed area. But the average population has now shrunk to about 300, including 150 to 200 employees of the Northern Pacific Railway Company. Less than 4,000 acres of the whole watershed is being used for agricultural purposes.

When the city started to operate its gravity system it provided sewer systems and septic tanks for all the isolated communities and camps, in the watershed, and concrete vaults for the individual dwellings. Those camps which started to operate within the watershed area subsequent to the completion of the gravity system had to provide the proper sanitary facilities at their own expense. All tanks and vaults are maintained in sanitary condition by the city.

In the matter of sanitary problems and fire protection within the watershed area, the Water Division of Tacoma has had excellent cooperation from the U. S. Forestry Department, which has established a very practical patrol system as well as patrol roads, trails, telephone lines, firebreaks, and outlook towers. After the last large forest fire, which occurred in 1924, the Northern Pacific Railway Company inaugurated a patrol system. This consists of a gasoline speeder, equipped with portable fire-fighting apparatus, which is sent over the mainline track in the watershed from three to four times daily. This has been very effective in eliminating forest fires started by sparks from passing engines.

The city maintains a watershed inspector at the head works who is deputized by the State Health Department, with police powers to enforce sanitary regulations under the code of the State Board of Health. It is his duty to see that all the sanitary requirements are complied with by people living within or passing through the area. He covers the several small communities every five to ten days and makes written reports of his findings to the Water Division. The cooperation of the railway company's employees and of the people in the various small settlements has been good. In fact, more has been accomplished by moral suasion than by arbitrary enforcement of the law. The inspector, who is a bacteriologist, takes water samples of the river and its tributaries practically every day and makes his own tests. Thus he has no trouble in tracing conclusively any pollution that might originate at any point above the city's intake. Passenger trains are inspected daily, and toilets on these trains must remain closed while trains are passing near the river. All railroad bridges are required to be covered with sheet-iron decking draining away from the river banks.

In addition, the inspector takes a monthly census of the number and location of all persons living in the watershed—information that is particularly helpful in tracing the whereabouts of special construction crews of the railway, power, and telephone companies. Thus up-to-date information is available at all times on all watershed conditions that might affect the quality of the water supply at its source. In the matter of safeguarding the water supply against possible pollution in the supply or distribution systems, the precautionary measures adopted by the city of Tacoma are similar to those used by the city of Portland, as described by Mr. Morrow.

For Tacoma, 1935 was the second successive year of freedom from typhoid deaths. In the same year, the average typhoid death rate for 11 large cities in the mountain and Pacific states was only 0.79 per hundred thousand of population, while the urban average for the country as a whole (93 cities) was 1.714 deaths per hundred thousand of population. These figures strikingly illustrate the value of the sanitation of public water supplies, and the progress that has been made in eliminating one of the diseases most prevalent 20 or 30 years ago.

W. A. Kunigk, M. Am. Soc. C.E.
Superintendent, Water Division
Department of Public Utilities

Tacoma, Wash.
October 23, 1936

Future of Irrigation in Western Washington and Oregon

To the Editor: As pointed out by George E. Goodwin, M. Am. Soc. C.E., in his article on "Benefits of Irrigation West of the Cascades," in the October issue, the annual precipitation in the Willamette Valley is intermediate between that of the Rogue and Umpqua valleys to the south and that of the coastal region to the west. This is also true of the summer rainfall, but there is very much less difference between the three regions in this particular. For instance, the precipitation for July and August combined is about $^2/_3$ in. at Roseburg, $^1/_2$ in. in the Rogue River valley, $^3/_4$ in. at Corvallis, less than 2 in. at Tillamook, and just under 1 in. at Marshfield. Somewhat the same relative differences occur in respect to the growing-season totals. In none of these places is the rainfall during these two months sufficient to keep crops growing rapidly unless they have very unusual moisture storage in the soil.

As a result of the lower rainfall, of a more intensive type of farming, and perhaps of other reasons, irrigation has now become thoroughly established in the Rogue River valley. However, when that valley was first settled and for many years thereafter it was believed that irrigation was not necessary. A very large planting of pears on unirrigated land in the so-called Country Club development near Grants Pass in 1912 furnishes evidence of that belief. That development has been entirely abandoned now on account of the shortage of moisture.

However, as far back as 1901 one canal company was organized in the area, and an irrigation system was partially completed by this company in the next ten years. During the second decade of the century the Medford, Talent, Grants Pass, and other projects were established. And by 1930 practically all orchards, which were not naturally subirrigated, were irrigated if water could be obtained.

Since 1930 irrigation experiments at Medford have shown that comparatively heavy irrigation is required to enable the Medford orchardist to meet the competition of other districts. Much better results are obtained by means of four or five irrigations than by the one or two that were common practice a few years ago.

In the Umpqua Valley there has been less development of irrigation. But farmers and orchardists are rapidly becoming interested in it, and there is every reason to believe that irrigation will be almost as useful there as in the Rogue River valley.

In the coast area dairying is by far the most important farm enterprise. Studies by the department of farm management of the Oregon Agricultural Experiment Station indicate that better cows, larger herds, and greater use of pasture all give lower production costs. But in spite of the fact that, on the average, the coast region dairymen have better cows, larger herds, and a longer pasture season than do the dairymen in the irrigated sections of the state, it costs these dairymen more to produce a pound of butterfat than it does the dairymen of eastern Oregon. The explanation seems to be the drying up of the coast pastures in July and August, and the solution appears to be irrigation. Mr. Goodwin has already shown the rapid increase in the applications for permits to appropriate water for irrigation along the coast.

It appears probable that the cycle of events in the Rogue River valley will be repeated in the Willamette Valley and, to some extent, along the coast. The early farmers, in the former region, did not use irrigation or believe in it, but gradually they have used it more and more until now it is almost a universal practice. In the Willamette Valley as in the Rogue River valley it is probable that certain crops, notably small grains, will not be generally irrigated. On the coast, irrigation will probably be confined to pastures and certain types of truck farming.

M. R. Lewis, M. Am. Soc. C.E.
Irrigation Engineer, Oregon State College
U. S. Bureau of Agricultural
Engineering

Corvallis, Ore.
November 2, 1936

SOCIETY AFFAIRS

Official and Semi-Official

Eighty-Fourth Annual Meeting to Open January 20, 1937

Technical Sessions Are Scheduled by Five Divisions, and Many Social Events Are Also on Calendar

On Wednesday, January 20, 1937, the Eighty-Fourth Annual Meeting of the Society will open in New York, with a varied and comprehensive program that should ensure the interest of every member. Technical sessions have been arranged by the Sanitary Engineering, Power, Highway, City Planning, and Structural Divisions; excursions and inspection trips are planned; and social events, formal and informal, for both members and ladies, will occupy the evenings and idle hours throughout the day.

A Typical Road Scene in Bermuda

Society business will be disposed of at the opening session on Wednesday morning. At that session, also, the formal ceremony of conferring honorary membership and awarding prizes will take place, and the President-elect will be inducted into office. Luncheon will be served in the building, and will be followed by an afternoon session on a topic of general interest. A formal reception, dinner, and dance in the evening will conclude the activities of the first day.

The schedule of Division programs on Thursday covers a wide field of up-to-the-minute papers and discussions. The Sanitary Engineering Division will have two sessions, with papers on water-softening plant design, sewage treatment, surge in water and sewer tunnels, and sewer maintenance. In the morning, the Power Division will hold a session at which the elements that enter into the determination of cost of electrical energy will be outlined and discussed; and the Highway Division will consider such topics as the objectives of state-wide highway planning surveys, the influence of major highway improvements on accidents, and the effect of the Henry Hudson highway on New York City traffic.

In the afternoon, the City Planning Division will take up two problems of zoning: "Rural Zoning as an Adjunct to State Highway Improvements," and "Practical Methods for Rezoning Urban Areas." The Structural Division has also arranged a program quite in contrast to the usual technical session. Instead of the customary somewhat analytical papers, this meeting contemplates papers less technical and more descriptive of the structural features of two or more major projects.

The most popular single event in connection with the Society's annual meetings has proved to be the smoker, and it is expected that last year's record-breaking attendance of 1,600 at this function will be exceeded in the coming one. It is to be held on Thursday evening, January 22, and arrangements are being made for a larger room and better facilities to accommodate the crowd.

On the calendar for Friday is an all-day excursion attractive to both members and ladies. On Saturday, in accordance with the usual practice, opportunities will be afforded for members to visit points of engineering interest in and near New York.

This, in brief outline, is the schedule of the Annual Meeting. There are a dozen other events of interest held in connection with it that cannot be listed in detail at the present time. Various colleges are planning luncheon and dinner reunions, and the committee in charge of entertaining the ladies has promised a number of innovations. Mention should also be made of the Student Chapter conference, which is expected to draw student delegates and faculty advisers from all parts of the country. A comprehensive program, including all these special functions, will appear in the January Civil Engineering.

The Board of Direction will meet on Monday and Tuesday, January 18 and 19, and again on January 21. The latter session will be the first official meeting of the newly elected board.

It has been customary in the past to issue reduced-fare certificates to the entire membership. This year, however, the plan has been discontinued, as the general reduction in rail rates has made the regular fares as low as, or lower than, any that could be obtained on the certificate basis.

Reservations for Society's Cruise to Bermuda Must Be Made Early

For the third successive year, a post-meeting trip to Bermuda has been arranged. For those who plan a mid-winter vacation, a cheaper or more attractive itinerary would be hard to find. The excursionists will sail Saturday, January 23, on the *Monarch of Bermuda*, a Furness-Bermuda line ship and one of the handsomest liners entering New York harbor. It is described as "a magnificent hotel on water, plus all the appointments of an exclusive club." Sunday will be spent at sea, with opportunity for swimming, deck sports, and dancing.

Headquarters in Bermuda will be at the Hotel Bermudiana, high on a bluff overlooking Hamilton Harbor. Three days in the Islands will give opportunity to visit the spectacular caves, see the unique submarine coral gardens, drive, rest, sail, or play golf. The return trip, also on the *Monarch*, will bring the excursionists to New York on Friday, January 29.

As in previous years, the Society has been able to secure liberal discounts for members and their friends. But members are warned that it is extremely important to make reservations early, in order to take advantage of these rates and ensure their obtaining the type of accommodations they desire; the *Monarch* is already more than half sold out for its January 23 sailing. Information on rates (including all expenses) and reservations can be obtained through the office of the Secretary.

The Hotel Bermudiana, Bermuda Headquarters for the Society's Post-Meeting Cruise

Engineers' Council Receives Grant from Carnegie Corporation

On October 22, 1936, the trustees of the Carnegie Corporation of New York resolved that "the sum of $16,000 be, and it hereby is appropriated to the Carnegie Foundation for the Advancement of Teaching, toward support of the program of the Engineers' Council for Professional Development."

Continued Carnegie interest in engineering activities is thus once again evidenced. It began in 1903 with a donation of $1,050,000 by Mr. Carnegie for erection of the Engineering Societies Building at 33 West 39th Street, New York City. In later grants the Carnegie Corporation has generously supported the Society for the Promotion of Engineering Education in its investigation of engineering schools extending over a period of five years, as well as the summer schools for engineering teachers instituted and maintained by that organization.

The present $16,000 grant is made in support of the work of the Engineers' Council for Professional Development (E.C.P.D.) for the year October 1, 1936, to September 30, 1937. Additional appropriations in the amount of $3,450 have been made to the Council by the Engineering Foundation. Rental cost for the Council's office recently opened in the Engineering Societies Building is expected to be met by three of the participating societies, the American Society of Mechanical Engineers, the American Society of Civil Engineers, and the American Institute of Electrical Engineers. Including this rental value, a total fund of over $21,000 is available, of which $19,450 will be applied directly to the advancement of the Council's program for enhancing the professional status of the engineer through the cooperative support of the national organizations directly representing the professional, technical, and legislative phases of the engineer's life.

In connection with the newly opened office of E.C.P.D., R. I. Rees is devoting full time to his duties as vice-chairman of the Council. General Rees is also chairman of the Committee on Professional Training and of the Committee on Ways and Means

The member organizations of E.C.P.D. are the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Institute of Chemical Engineers, the Society for the Promotion of Engineering Education, and the National Council of State Boards of Engineering Examiners.

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Professional Records of Official Nominees

Brief Biographical Sketches of Candidates for Society Offices

Louis C. Hill

Louis C. Hill was born in Ann Arbor, Mich., on February 22, 1865. He was graduated from the University of Michigan in 1886 with the degree of bachelor of science in civil engineering, and in 1890 received the degree of bachelor of science in electrical engineering. In 1911 the University of Michigan conferred upon him the honorary degree of master of engineering.

From 1890 to 1903 Mr. Hill was professor of hydraulics and electrical engineering at the Colorado School of Mines, and from 1903 to 1914 he held, successively, the positions of engineer, project engineer, and supervising engineer in the U. S. Reclamation Service. During this period he was in charge of construction of the Salt River Project (including Roosevelt Dam), the Yuma Project, and projects in New Mexico and Texas. He was also in general charge of the Colorado River basin.

Construction of Roosevelt Dam necessitated building roads through extremely rugged country, construction and operation of a cement mill, and the development of hydroelectric power. Among the works included in the Yuma Project were Laguna Dam, the large inverted siphon under the Colorado River, and canals and levees for flood protection. The Rio Grande project in New Mexico and Texas involved the construction of a series of diversion dams along the Rio Grande, canal systems, drainage works, and the design and initial construction of Elephant Butte Dam.

Mr. Hill entered private practice in March 1914, and since that time has been retained as consulting engineer by the U. S. Bureau of Reclamation, then the U. S. Reclamation Service. He is a member of the consulting engineering firm, Quinton, Code, and Hill—Leeds and Barnard, of Los Angeles, Calif.

Since 1914 Mr. Hill has been connected with many engineering projects. Among the more important were Gibraltar Dam, a concrete arch structure on the Santa Ynez River, constructed for the city of Santa Barbara; and Pine Canyon Dam (now Morris Dam), constructed on the San Gabriel River for the city of Pasadena; the Big Tujunga Dam on the Big Tujunga; Bouquet Canyon Dam and various works for the Los Angeles County Flood Control District; and Sutherland and El Capitan dams for the city of San Diego, Calif. He has been consulting engineer for the state of California on various dams, and consulting engineer on the Yaqui River project in Mexico.

As a member of a board of engineers, Mr. Hill made recommendations to the city of Austin, Tex., on acceptance of plans for (1) building a new dam and for (2) replacing and repairing an old structure that had been destroyed. He was the American member on the commission for the distribution of the waters of the Rio Grande and Colorado rivers, and represented the U. S. Bureau of Reclamation on the consulting board on the Columbia Basin project. He was consulting engineer for the U. S. Indian Service on the construction of the Coolidge Dam on the Gila River in Arizona, and has served as consultant to the International Water Commission.

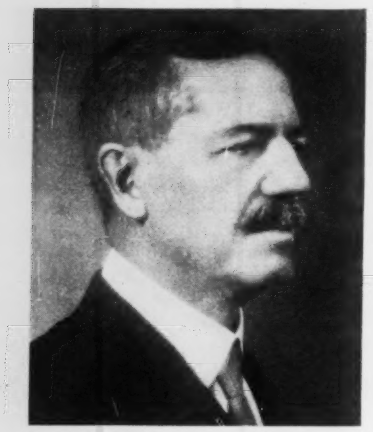
At present Mr. Hill is consulting engineer to the Corps of Engineers of the U. S. Army on fourteen dams near Zanesville, Ohio; Conchas Dam on the Canadian River in New Mexico; Tygart Dam in West Virginia; Bluestone Dam near Grafton, W.Va.; Sardis Dam, a hydraulic structure near Vicksburg, Miss.; Fort Peck Dam on the Missouri River in Montana; and the Bonneville Dam and locks and large power plant on the Columbia River near Portland. He is a member of the board of consulting engineers on Boulder Dam, on Imperial Dam, and on the All-American Canal.

In 1905 Mr. Hill became a Member of the Society, of which he served as Vice-President in 1928 and 1929.

Louis C. Hill
Nominee for President of the Society

LYLE F. BELLINGER

LYLE F. BELLINGER, born of Palatine and English stock, represents the eighth generation in this country. He was born on January 10, 1867, in Mohawk, N.Y. He won a state scholarship to Cornell University, from which he graduated in 1887 with the degree of C.E. Later he obtained the degree of M.S. at Norwich University and for two years was professor of civil engineering there. At this time he was a second lieutenant in the Vermont militia.



LYLE F. BELLINGER
Nominee for Vice-President, Zone II

Commander Bellinger's professional career began with work on the Carthage and Adirondack Railroad. Later he was chief engineer for some railroad lines in Georgia and Alabama, and superintendent of construction of the Atlanta Electric Railway Company. From 1892 to 1899 he had an engineering practice in Atlanta, Ga., specializing in hydraulic power surveys and construction and in highway bridge work.

He was consulted unofficially on the water works of Ilion, N.Y., and Northfield, Vt., and in connection with pressure grouting for stopping leaks in the Catskill Aqueduct.

During the Spanish-American War he served as captain, 3d U. S. Volunteer Engineers, in the United States and Cuba, and was acting major for two months. In 1901 he joined the Civil Engineer Corps of the U. S. Navy, where he remained until his retirement in 1931. During this period he served in navy yards at Portsmouth, N.H.; Newport, R.I.; New London, Conn.; Brooklyn, N.Y.; Philadelphia, Pa.; Norfolk, Va.; Gulfport, Miss.; New Orleans, La.; Puget Sound, Wash.; and Cavite, P.I.

While Commander Bellinger was in the navy he was concerned with the final acceptance test of the first subsurface electric pumping plant for dry docks in the United States. A similar plant for Dry Docks No. 2 and No. 3 at Brooklyn, N.Y., was constructed under him. He was in direct supervision of the construction of the coaling pier, some of the large buildings, and sea walls at the Brooklyn Navy Yard, and also supervised the design, construction, alteration, and/or operation of twelve navy power plants. He was in charge of hospital construction at Newport, R.I., and supervised the design and/or construction of all but one of the permanent buildings at the New Orleans Naval Station.

Commander Bellinger has been responsible for the development of original methods in engineering work, such as the use of cement grout applied with air pressure for stopping leaks through sheet piling and "firming up" quicksand; driving piles to moderate final penetration instead of to practical refusal; and abandoning the use of dry concrete in favor of water-controlled plastic concrete, before the scientific development of that method of control.

He is the author of discussions in the TRANSACTIONS of the Society and is a contributor to the National Building Code. He wrote a monograph on "Expansion Joints in Concrete," which was published in *Engineering News* in 1907, when little was known on the subject. His hobby is historical research and family genealogy.

Commander Bellinger belongs to the Masons, the Committee of 33 National Sojourners, the Army and Navy Club (Washington, D.C.), the New York Chapter of The Naval and Military Order of the Spanish-American War, and the Cornell Society of Engineers. He became a Member of the Society in 1901 and is now serving as secretary of the Georgia Section.

OFFICIAL NOMINEES FOR 1937

For President:
Louis C. Hill, of Los Angeles, Calif.
For Vice-Presidents:
Zone II, L. F. Bellinger, of Atlanta, Ga.
Zone III, R. C. Gowdy, of Denver, Colo.
For Directors:
District 1, William J. Shea and Enoch R. Needles, of New York (two to be elected)
District 2, Arthur W. Dean, of Boston, Mass.
District 6, R. P. Davis, of Morgantown, W. Va.
District 10, T. Keith Legaré, of Columbia, S. C.
District 13, Thomas E. Stanton, Jr., of Sacramento, Calif.

ROY C. GOWDY

ROY C. GOWDY was born in Washington, Iowa, on September 3, 1878. During his childhood and youth, he lived in Colorado Springs, Colo., where he attended grade and high school. Part of one year he was a student at Colorado College, doing special work in mathematics, chemistry, and other subjects. His subprofessional work from 1899 to 1906 included engagements as rodman and instrumentman on the location, construction, and maintenance of the Colorado Springs and Cripple Creek District Railway; as rodman and field draftsman on preliminary and location surveys for, and as instrumentman on the construction of the Denver, Northwestern and Pacific Railway Company; and as draftsman and engineer-clerk in Colorado Springs.

ROY C. GOWDY
Nominee for Vice-President, Zone III

In 1906 Mr. Gowdy went to the Fort Worth and Denver City Railway Company as assistant engineer, subsequently becoming resident engineer. In 1908 he was appointed chief engineer of the company and of the Wichita Valley Lines, continuing in that position (except for a short period) until September 1918, when he was appointed corporate chief engineer of the Colorado and Southern Lines. In March 1920, he became chief engineer of the Colorado and Southern Railway Company, the Fort Worth and Denver City Railway Company, and the Wichita Valley Lines, which position he has held until the present time. His appointment as corporate chief engineer of the Colorado and Southern Lines made it necessary for him to remove from Fort Worth, Tex., to Denver, Colo., where he has since resided.

During his connection with the Fort Worth and Denver City Railway Company, Mr. Gowdy has been in charge of the rebuilding of much of its mainline track, the reconstruction in permanent form of many of its bridges, and the construction of switching terminals, engine terminals and shops, depots, and other structures. Among the bridges reconstructed under his charge was a structure across the Canadian River in the Texas Panhandle. He also supervised the location and construction of more than 300 miles of railroad in the Panhandle. This work involved the examination of large areas of country and the selection of alternate routes.

In Colorado and Wyoming, Mr. Gowdy was in charge of the relocation in places of the main line of the Colorado and Southern Railway Company, and he has conducted extensive surveys for railroad relocation in southern Colorado and New Mexico.

As chief engineer of the Colorado and Southern Railway Company, he has been in charge of its valuation work, and as corporate chief engineer, he assisted other officers of the corporation in making a settlement with the Federal Railway Administration.

Mr. Gowdy became a Member of the Society in 1916. When District 16 was created in 1930, he was appointed by the Board of Direction to be its first Director, his term expiring in January 1932. In 1918 he served as president of the Texas Section of the Society, and he was president of the Colorado Section from June 1927 to June 1928. For the two-year period ending June 1936 he was president of the Colorado Engineering Council, and he has been a delegate from the Colorado Engineering Council to American Engineering Council for the past five years. He is a member of the American Railway Engineering Association, the Colorado Society of Engineers, and by appointment was a member of the first state planning board of Colorado.

William J. Shea

William J. Shea was born in Cold Spring-on-Hudson, N.Y., on February 5, 1881. Following his graduation from the Haldane School, he entered the employ of the engineering department of the New York Central Railroad. For the next eight years he was engaged in railroad work for both the New York Central and the Cuba Eastern railroads. In 1908 he joined the staff of the Bureau of Highways, Brooklyn, N.Y., remaining until 1916, the latter six years as division engineer.

William J. Shea
Nominee for Director, District 1

From 1917 to 1921 Colonel Shea was with the Corps of Engineers, U. S. Army, on the staffs of the chief engineer of the A.E.F., and of the chief of engineers of the U. S. Army. In 1921 and 1922 he was terminal engineer for the Board of Economics and Engineering of the National Association of Railroad Security Owners. In the latter year he became assistant engineer on the Narrows Tunnel, and subsequently has been with the New York City Board of Estimate and Apportionment. Since 1934 he has been Liaison Officer for Public Works, Office of the Mayor, New York City.

Colonel Shea became an Associate Member of the Society in 1919 and a Member in 1922. At present he is secretary of the Metropolitan Section. He is also a member of the Society of American Military Engineers and of the Engineers' Club of New York.

Enoch R. Needles

Enoch R. Needles was born at Brookfield, Mo., on October 29, 1888, and graduated from the Missouri School of Mines in 1914 with the degree of B.S. in C.E. In 1920 he received his C.E. degree from the same institution. He is a member of the honorary fraternities Tau Beta Pi and Phi Kappa Phi.

After college Mr. Needles had a year of varied experiences, including railway valuation and mine surveying. Then came a year as draftsman in the track department of the Kansas City Terminal Railway, and another in the bridge department. In 1917 he entered the office of Harrington, Howard and Ash, bridge engineers, remaining with this firm until its dissolution in 1928. At that time, Ernest E. Howard and the late Louis R. Ash, Members Am. Soc. C.E., joined with Henry C. Tammen, M. Am. Soc. C.E., and Mr. Needles in forming the partnership Ash - Howard - Needles and Tammen, consulting engineers. This firm maintains designing offices in New York and Kansas City.

Enoch R. Needles
Nominee for Director, District 1

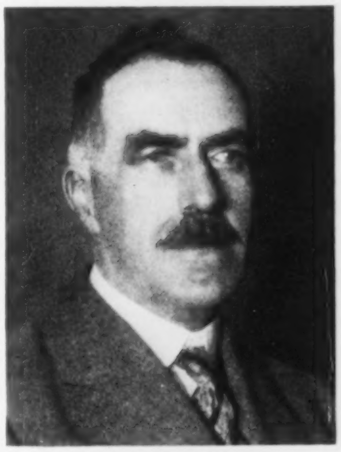
The principal work of Mr. Needles' firm relates to the design and construction of bridges, both fixed and movable. In recent years this work included the design of the Burlington-Bristol vertical-lift span over the Delaware River, the first structure to provide a movable span over a 500-ft navigable channel, and the design of the Missouri River bridge at South Omaha, Nebr. His firm also acted in an advisory capacity on the construction of the Pulaski Skyway over the Hackensack and Passaic rivers. Current work includes the Intercity Viaduct reconstruction at Kansas City; additions and betterments to the Mississippi River bridge at Vicksburg, Miss.; the Grand Avenue Viaduct at Sioux City, Iowa; the 63d Street Blue River bridge at Kansas City; the Shark River bridge for Monmouth County, N.J.; five movable spans for the state of New Jersey; the Chemung River bridge at Corning, N.Y.; and the design of the Neches River bridge, Jefferson County, Texas. The design of the latter structure provides for hurricane winds on a high-level bridge, with deep foundations in soft material. His firm was also responsible for the design of the Harlem River and Bronx Kills crossings, parts of the recently completed Triborough Bridge in New York City.

Mr. Needles is a member of the American Institute of Consulting Engineers, the Engineers' Club of New York, and the National Society of Professional Engineers, with registration in New York, New Jersey, and Florida. He now serves the Society as chairman of its Committee on Fees and also as representative on the Engineers' Council for Professional Development. In the past he has served as member and as chairman of the Society's Annual Meeting committee, and has been instrumental in developing relief engineering projects. Mr. Needles has been director and vice-president of the Metropolitan Section of the Society, and chairman of its Committee on Juniors. At present he is chairman of the Section's Special Committee on Aims and Activities.

Arthur W. Dean

Arthur W. Dean was born at Taunton, Mass., March 27, 1870. He was educated in the Taunton public schools and the Massachusetts Institute of Technology. During the summer vacations and for four years after leaving college he was engaged as surveying assistant, timekeeper, and inspector on various projects in the vicinity of Taunton, Mass., and Nashua, N.H. In January 1896 Mr. Dean became city engineer of Nashua, continuing in this position until 1900, when he resigned to become chief engineer in charge of the construction of a system of electric railways in southeastern New Hampshire and northeastern Massachusetts, involving completion of about a hundred miles of line.

After this work was completed, he continued as chief engineer until January 1904, when he resigned to accept an appointment as state highway engineer of New Hampshire. In this position he organized the New Hampshire State Highway Department, of which he was head until January 1910, when he resigned in order to become chief engineer of the Massachusetts Highway Commission. After the consolidation of the Massachusetts state departments in 1919, creating a Department of Public Works having jurisdiction over highways, harbors, waterways, and public lands, Mr. Dean was made chief highway engineer of the new department. He continued in this capacity until 1927 when he became chief engineer, remaining in this position until October 1935, when he was transferred to his present position as chief engineer of the newly created Massachusetts State Planning Board.



Arthur W. Dean
Nominee for Director, District 2

He has held offices of honor in various societies, including that of president of the American Road Builders Association in 1916 and 1917, and that of president of the Boston Society of Civil Engineers in 1933 and 1934. He became a Member of the Society in 1904, and during his period of membership has served on several Society committees.

Roland P. Davis

Roland P. Davis was born August 2, 1884, in Beverly, Mass., where he lived until 1906. In that year he graduated from Massachusetts Institute of Technology with the degree of bachelor of science in civil engineering. In 1908 he received the M.C.E. degree from Cornell University, and in 1914 the degree of Ph.D. from the same university. He was employed as draftsman by the American Bridge Company in 1906 and 1907, and from 1908 to

1911 he served as an instructor in civil engineering at Cornell University.

In 1911 he accepted a position as associate professor of structural and hydraulic engineering at West Virginia University, where he has successively held the positions of professor, assistant dean, and dean. He was appointed to the last-named position in 1932. In addition to his university work, Dean Davis was bridge engineer for the state road commission of West Virginia from 1914 to 1919, and has been consulting bridge engineer since 1919. In the latter capacity, he has been responsible for the several editions of the standard bridge specifications of that commission. On leave of absence, in 1918, he served as division engineer at Camp Abraham Eustis, at Lee Hall, Va.

ROLAND P. DAVIS
Nominee for Director, District 6

He is a member of the American Railway Engineering Association (committee on iron and steel structures), the American Society for Testing Materials, the Society for the Promotion of Engineering Education, and the West Virginia Society of Professional Engineers, of which he is a director. He is a registered professional engineer in West Virginia.

Dean Davis is co-author of Jacoby and Davis' *Foundations of Bridges and Buildings* (1924) and Jacoby and Davis' *Timber Design and Construction* (1930). He is an associate editor of Kidder-Parker's *Architects' and Builders' Handbook* (1931), and of O'Rourke's *General Engineering Handbook* (1932). He is also the author of numerous bulletins, technical articles in the engineering press, and technical papers presented before engineering societies. He joined the Society as a Junior in 1910 and attained full membership in 1918. For the past few years he has been chairman of the local (West Virginia) membership committee of the Society.

T. KEITH LEGARÉ

T. KEITH LEGARÉ was born at Fort Motte, S.C., on August 7, 1884, and has resided at Columbia, S.C., since childhood. His education was obtained by means of private schools, night school, and correspondence school courses. A certificate of qualification as a professional engineer was issued to him October 10, 1933, by the committee of the National Bureau of Engineering Registration, with an experience rating of 28 years of professional work, 23 years in responsible charge, and 10 years of design.

T. KEITH LEGARÉ
Nominee for Director, District 10

From 1900 to 1906 Mr. Legaré was employed as draftsman and rodman by several prominent architects and engineers. In 1906 he entered the service of the city of Columbia, S.C., for a 12-year period, holding successively the positions of transitman, draftsman, inspector, superintendent of streets, assistant city engineer, and city engineer. From 1920 to 1928 he was southern district manager for Dow and Smith, consulting chemical and paving engineers, New York City. During the same period he was connected with companies manufacturing concrete sewer and culvert pipe, as sales engineer, sales manager, and vice-president. He invented and patented an adjustable crown templet, and conducted a general practice for three years. Accepting an appointment with the South Carolina State Highway Department in January 1931 he has served as consultant on highway construction in municipalities, as traffic engineer, and for the past four years as chief labor inspector in supervisory charge of federal labor requirements on all highway projects in the state.

Mr. Legaré has been active in Society affairs, having served as chairman of the Society's local membership committee for South Carolina since 1926 and as Society contact member for the University of South Carolina Student Chapter since 1930. From 1929 to 1933 he was a member and, for two years, chairman of the Society's Committee on Registration of Engineers, compiling the original draft of "A Model Law for the Registration of Professional Engineers and Land Surveyors." After some amendments, this model law was approved by the Society and other national engineering organizations and is now generally used as the basis for registration laws as they are enacted in the several states. Mr. Legaré has been a member and secretary of the South Carolina State Board of Engineering Examiners since 1922, as well as executive secretary of the National Council of State Boards of Engineering Examiners since 1923 and of the National Bureau of Engineering Registration since 1931. He is also a former president of the National Council of State Boards of Engineering Examiners, and since 1932 has represented this organization on the Engineers' Council for Professional Development.

He is a member and one of the founders of the South Carolina Society of Engineers. "The Silver Beaver Award" of the National Council of the Boy Scouts of America has been presented to him for "distinguished service to boyhood," and he has been Scout Commissioner for 18 years.

THOMAS E. STANTON, JR.

THOMAS E. STANTON, JR., was born in Los Angeles, Calif., on May 31, 1881, and graduated from the University of California in 1904, with the degree of B.S. in mining engineering. In the spring of 1905, after several months in the employ of the Southern California Edison Company and in the Los Angeles office of the Salt Lake Railroad, Mr. Stanton entered the office of the city engineer of Los Angeles. He was employed there for the following seven years as assistant engineer on the design of sanitary and street-paving projects, including the preparation of specifications.

THOMAS E. STANTON, JR.
Nominee for Director, District 13

In 1912 he entered the employ of the California State Highway Department under the jurisdiction of the State Highway Commission, and has remained continuously in the employ of the California Divison of Highways since that date. He has served in the capacities of assistant division engineer and assistant state highway engineer, and is now chief of the Department of Materials and Research.

Mr. Stanton has been active in technical matters connected with the construction of bridge and highway pavements. These activities have included extensive research, particularly in the development of portland cement and asphaltic cement specifications, and of information and tests on steel, timber, portland cement, and asphaltic cement construction.

He became an Associate Member of the Society in 1919 and a Member in 1920, and is a former president of the Sacramento Section of the Society. He served as chairman of the local committee in charge of the 1930 Spring Meeting of the Society when it was held in Sacramento, and is a member of the Society's Committee on Aims and Activities, a member of the American Association of State Highway Officials, the American Concrete Institute, the American Society for Testing Materials, the Highway Research Board, and the Association of Asphalt Paving Technologists. He has served on various committees of these societies. He is a registered civil engineer in the state of California and a member of the Sacramento Rotary Club.

Soil Mechanics and Foundations Division Outlines Scope of Its Activities

The International Conference on Soil Mechanics and Foundation Engineering, held under the auspices of Harvard University in June 1936, served to introduce soil mechanics to the profession as a new phase of civil engineering. Active in this conference were many members of the American Society of Civil Engineers. In past years the Society has taken an active interest in the development of this subject through its committees on Bearing Value of Soils for Foundations, and on Earths and Foundations, as well as through the committees of the various Technical Divisions. The Society has also published numerous papers and reports on this subject.

Having been presented with a petition for the formation of a Soil Mechanics and Foundations Division, and recognizing that leadership in this field was a proper function of the Society, the Board of Direction in July authorized the formation of the Division and placed the responsibility for its organization on Carlton S. Proctor, M. Am. Soc. C.E. Letters were sent to those members of the Society who had identified themselves with this subject by their interest in the International Conference, requesting their cooperation and suggestions in the formation of the new Division. As a result of their suggestions, a ballot was prepared for the choice of an executive committee of the Division, and was voted upon by these members. The Division was formally organized at the October meeting of the Board of Direction, which approved the constitution and the membership of the executive committee.

The scope of the activities of the Division is confined to soil mechanics and foundation engineering. Soil mechanics is interpreted to include the adequacy of soil slopes, structures composed of soil, external loads on structures supporting soil, and soil foundations of structures. Foundation engineering is interpreted to include, in addition to the soil mechanics features thereof, methods and principles of the design and construction of the foundations of structures.

The objects of the Division are to increase knowledge in, and the advancement of, the science of soil mechanics and of foundations, and to facilitate the interchange of such knowledge among its members. To this end it will: (1) originate and, upon assignment, make inquiry in directions inadequately developed; (2) survey the field and record advances and improvements as they are made; (3) elicit authoritative papers on important phases within its field.

The Society is not the only national organization taking an active interest in the development of this science. Happily others also are interesting themselves and actively organizing to aid in its development. Many members of the Society are connected with the work being carried on by other organizations, and through them it is anticipated that worth-while developments may be reported.

One of the most persistent demands at the present time is for standardization. The practicing engineer desires to have the subject neatly presented in convenient handbook rules for his use; the engineering teacher wants the subject standardized for presentation to his students so that he can give them a course as good as any presented elsewhere; the laboratory technician desires a set of standard tests so that he can receive a soil sample and pass it through an exact routine to produce a standardized report. Similar desires are entertained by other interested groups.

The executive committee of the Division wishes that it could answer this demand. Unfortunately it is faced by the recognized condition that standards are created by practice and not by committees. It is felt that an extensive program of standardization would result in the stultification of the development of this infant science, and the executive committee therefore takes the view that standardization is largely for the future. But it can materially assist by encouraging worth-while research and directing investigations into fields that need further development. It can assist those engaged in research by initiating arrangements to secure basic data and measurements and transmit such information to those interested. It can survey the field and record improvements and methods as they are developed and report their applicability as they are tested in practice. It can encourage the preparation of authoritative papers at the proper time, and through committee reports keep the profession advised as to the state of the science.

These things the executive committee proposes to accomplish through the activities of the Division's committees, with the cooperation of the membership of the Society in general and that of the Division in particular. It is hoped that all those interested in the subject will advise the Secretary of the Society that they desire to be enrolled in the Division, so that they can be called upon to participate in its work.

T. T. Knappen, M. Am. Soc. C.E.
Secretary, Soil Mechanics and Foundations Division

Manual on Flood Control Plant and Methods to Be Issued Soon

With flood control projects large and small about to get under way in all parts of the country, the Manual of Engineering Practice soon to be issued by the Society is of especial timeliness and should be assured of a welcome reception. Number 12 in the series, it is entitled "Flood Control Plant and Methods on the Mississippi River and Similar Streams." The Manual is now in the hands of the printer, and is expected to be distributed to all members of the Society before the end of the year.

Although the Mississippi River work provides the background for most of the text, many of the plant layouts described are in no wise limited to streams of that size. The mule-drawn scraper outfit, for example, is not neglected—though its day of usefulness on the "big" jobs has passed. The subjects treated include levees, bank stabilization structures, and channels. Each type of structure is described briefly, but the major emphasis is on construction plant. The discussions include such items as plant cost, limits of applicability, personnel requirements, and daily output.

More than forty illustrations, most of them construction pictures, are interspersed through the text and add much to the value and attractiveness of the presentation. The Manual concludes with a comprehensive bibliography of magazine articles and books on various phases of flood control engineering.

Heavy Going on a Levee Project

The Manual on Flood Control Plant and Methods Has Many Pages of Similar Pictures, Showing Construction Equipment in Operation

Manual No. 12 is the product of the Committee of the Construction Division on Construction Plant and Methods, through its Subcommittee on Flood Control. The subcommittee (now discharged) was composed of L. L. Hidinger, chairman, and John T. Chambers, R. G. Church, H. S. Gladfelter, George B. Massey, and A. F. Stanford, all members of the Society.

During the current year a great deal of editorial work on similar material has been accomplished. This will result in the publication shortly of other manuals and reports. Among the subjects in preparation are manuals on materials for use in trickling filters and on definitions of surveying terms; also reports on sand for water filters and on sludge digestion. The manuscripts are in various stages of editing, author's review, or printing procedure. It is hoped that one or more of them may also be distributed before the close of the year.

What an Employer Looks for in a Young Engineer

Culture and Versatility Rated Among the Most Important Qualities

By HARRISON P. EDDY, PAST-PRESIDENT AM. SOC. C.E.

METCALF AND EDDY, CONSULTING ENGINEERS, BOSTON, MASS.

Speaking before the Student Chapter conference at Pittsburgh on October 16, 1936, Mr. Eddy outlined a number of qualifications for success in engineering. To the young man still in school, or looking for his first job, they are important indeed—but they may be reviewed with profit by many an engineer further along the road. The following paragraphs are an abstract of Mr. Eddy's address.

IT IS my impression that about the most important subject in the mind of the student is how and where he is going to get a job when he finishes college. I have been asked to say a few words from the point of view of an engineer in private practice as to the qualities which influence the selection and the retaining of engineering employees.

Private practice requires that the income must be enough to pay the expenses and, if possible, to have a little left over for the principal. The point of view of the engineer in private practice may therefore be somewhat different from that of an employing engineer in a great corporation like a railroad or a public utility, or in a governmental department, where the financial balance of the engineering department of itself may not be quite so important.

Some qualities are almost self-evident or academic, such as natural aptitude for engineering, which a man must have if he is to succeed in an office of this kind. Capability is another obviously necessary quality.

It is assumed that the potential employee has a sound fundamental education in engineering. In our office, we are not so anxious that he shall have specialized in his education as that he have a broad foundation. If a man is always going to be an assistant civil engineer I would prefer a graduate of a civil engineering course, for the reason that at the outset he will have proceeded further in that field and can do effective work more promptly than if he were not so trained. But if I want a man who ultimately is going to be a partner in our firm, I prefer one from the broadest possible course, because, while he has not had so intensive a course in one line, he has had an engineering foundation in the civil, mechanical, electrical, chemical, and biological fields. The important thing for the man who is going to rise to the top in such an office is a broad foundation, because he not only has to function in civil engineering; his practice requires knowledge in these other fundamental subjects as well. Theoretically, a course in sanitary engineering might answer the requirements, but practically, few if any such courses are planned to give as broad a foundation as that outlined.

Initiative is also important. A man who has imagination and can take up problems, going ahead without having to be led by the hand to each individual step, is more helpful than one without this quality. Originality, ingenuity, and ability to solve difficult problems in the right manner, sometimes in an entirely new manner, are valuable attributes.

Then comes judgment. The engineer who has good sound judgment, which might almost be paraphrased as common sense, has a distinct advantage.

Another quality is dependability. This doesn't mean that a man should be at work at any particular hour each morning, but rather that when he has solved his problem, the result can be depended upon. Some engineers are rapid thinkers. They may think out the solution of a problem almost while it is being described, but in some cases one feels an uncertainty as to the result. Others may be relatively slow, but thorough students. When they report, one feels that no further consideration need be given to the method of solution, but that the results can be accepted.

Another qualification is self-assurance—a tenacity of opinion until proved to be wrong. A man should not be bowled over just because somebody who may be a little older or who has a little different point of view questions what he has done. He should have sufficient self-assurance to enable him to demonstrate that he is right—if he is right. If he is wrong, he should frankly acknowledge his error.

Personality is important. One must be agreeable and pleasant to associate with, and must have the ability to work with others. You can hardly imagine that a staff of engineers working in the same room, upon the same problem, will produce good results unless they are able to work harmoniously and helpfully with one another.

It goes without saying that one must have good health. If there is anything the individual can do to promote his health, he should do it.

Then there is the matter of appearance. He should be neat in person and in clothing. Frequently engineers are sent into the offices or factories of clients. The impression made is important to the firm.

Another quality is experience. It takes a long time to break in a man, and to give him experience not only in the peculiarities of the individual office, but in the general field of work in which he is to be employed.

ENGINEERS SHOULD BE LEADERS IN COMMUNITY AFFAIRS

We expect our men to be leaders; leaders in our office; leaders in society work; leaders in their home communities. Several of our engineers have been prominent in town affairs, chairmen of important committees that have expended hundreds of thousands of dollars in building schools, sewers, and other improvements, or have held other offices of trust in church, hospital, and other community projects.

Several have headed engineering societies, such as the Boston Society of Civil Engineers and the New England Water Works Association; others have been chairmen of professional committees. We try to select leaders, and we are inclined to retain those who become leaders, sometimes in preference to those who do not develop that quality. To encourage leadership as well as professional development, we have paid expenses and given time without loss of pay for attendance at meetings of professional societies. In some years, this policy has cost us a considerable sum in traveling expenses and loss of productive output, but it has developed bigger and broader men.

Finally comes the matter of cultural development, and in that connection I want to refer you to the work of the Engineers' Council for Professional Development. One of the committees of the Council has prepared lists of books for home reading. It is post-collegiate work directed primarily at cultural development. It is desirable that an engineer develop himself along cultural lines. There is not time in the four-year course to take up much cultural work, but there is opportunity in most cases for the graduate to take up such work in later years.

The importance that we attach to cultural development is illustrated by the fact that we undertook, some ten years ago, to send each year one of our younger partners to Europe at a substantial expense to the firm. His traveling expenses were paid and he was allowed two months or more of time, without loss of pay. The only requirements were that he should take his wife and that he should devote only a minimum of time to professional sightseeing. Our object was to broaden the horizon of these men who were representing the firm in its dealings with clients.

These qualities I have mentioned, of which perhaps culture and versatility are as important as any, are those which are not only going to lead to your success, but are going to provide your happiness in carrying on your life work. In this connection, the following clipping is pertinent:

"One of the most successful men I know has about the least possibility of ever accumulating much of an estate. He earns a comfortable salary, but insufficient to ever establish him as a man of wealth. However, he has equipped himself for living by a liberal education and a devotion to his line of work. He has no time to loaf, but he has time to devote to interesting recreations. When one learns to live sanely and wisely, he is a success even though he hasn't a dime."

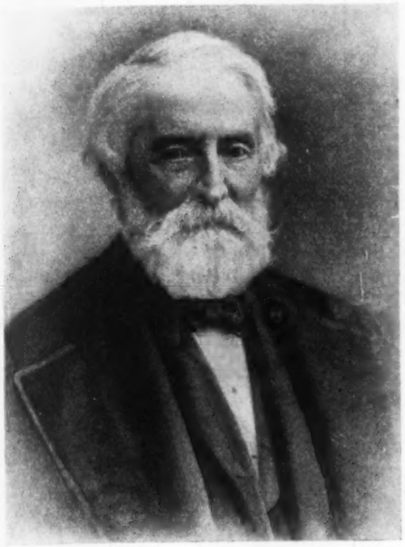
Early Presidents of the Society

In connection with this series of brief biographies of early leaders of the Society, it is urged that any one acquainted with personal details in the lives of these men, or possessed of photographs of engineering works with which they were connected, communicate the information to Society Headquarters. The next three installments will be concerned with Albert Fink, James Bicheno Francis, and Ashbel Welch.

IX. WILLIAM MILNOR ROBERTS, 1810–1881

President of the Society, 1878–1879

THE ENGINEERING BUILDING of Montana State College is dedicated to the memory of William Milnor Roberts, whose surveys fixed the route of the first transcontinental railroad across that state. It is hard to realize that this Roberts, chief engineer of the Northern Pacific in his prime, was the same one who as a young man had straightened out traffic snarls among the horse-drawn trains on the first road across the Alleghenies. Truly such a development of the American railroad net within a single lifetime is an epic of engineering achievement.



WILLIAM MILNOR ROBERTS
NINTH PRESIDENT OF THE SOCIETY

And just as certainly, Roberts, one of the few railroad pioneers who kept up the pace, is one of its heroes. From the days of the horse-cars to the days of the transcontinental, his skill and energy were bent wholeheartedly to the task of wiping out distances.

Roberts was born in Philadelphia on February 12, 1810. He was educated at one of the schools of the Society of Friends, and studied architectural drawing at the first school established by the Franklin Institute. At the age of 21, with six years of experience on the Union and Lehigh canals behind him, he was made a senior assistant engineer on the proposed Allegheny Portage Railroad.

This road, 37 miles in length, was the final link between Pittsburgh and the seaboard. Its purpose was to transfer canal-borne freight from Hollidaysburg, on the eastern side of the Alleghenies, to Johnstown (on the Conemaugh) on the western. At that early period, the crossing of the Alleghenies was a formidable task. Most engineers were firmly convinced that locomotives could do very little work on grades of more than about 30 ft per mile; in fact, in England several "inclined planes," worked with ropes and stationary engines, had been built on grades of barely 1 per cent.

That the Allegheny Portage road should incorporate inclined planes was therefore a foregone conclusion—it was specified, in fact, by legislative act. Although Roberts was not in general charge of the design, he made various improvements in it, and on completion of the road he was put in charge of operations. The first cars, drawn by horses on the levels, passed over the road on November 21, 1833. "They started in the morning from Johnstown," wrote Roberts, "and about 10 o'clock that night, in the midst of a snow storm, . . . were delivered safely in Hollidaysburg." In the spring of the following year the road was regularly "opened to the public." And this was literally true, "for any persons who chose could put cars on the track, and haul them, with their own horses, from either end to the foot of the first plane, and on the levels between the planes." The state merely transported the cars up and down the inclines. Roberts added that this system soon became "exceedingly troublesome."

Some of the planes were on a grade of as much as 10 per cent. The machinery that worked them was simple. An endless rope, about 3 in. in diameter, passed around a large horizontal wheel at the head and foot of each plane. Along the slope it was supported on numerous sheaves, set in the middle of the tracks. The stationary engines had double cylinders, and were rated at from 30 to 40 hp each. Cars moving up one track were balanced, as nearly as might be, by those moving down the other.

"The freight cars were all four-wheeled, and weighed from 3 to $3^{1}/_{2}$ net tons each. The passenger cars . . . seated comfortably 25 persons inside, and . . . accommodated an indefinite number outside. We frequently 'put the passenger cars through' over the 37 miles, including the passage of the 10 inclined planes, in about 5 hours, and sometimes . . . in four."

Some 20 years after the Allegheny Portage Railroad was built, the State of Pennsylvania replaced it with a "graded" road, and Roberts was chairman of the commission that advised on the construction. A short time later the Pennsylvania Railroad Company became the owner of all the state railroads and canals between Philadelphia and Pittsburgh. In this connection Roberts made the comment that he had "attended the birth of the state railroads, assisted them in their mature growth, and witnessed their final obsequies, all in a period of about 25 years."

Roberts remained in charge of the portage for about a year, leaving in 1835 to become chief engineer of the Lancaster and Harrisburg. For this road he designed and built, at the age of 27, a structure which at the time was probably unique in American engineering practice—a double-deck lattice-truss bridge across the Susquehanna, with a double-track railroad on the upper deck and a carriageway and footpaths on the lower.

For the next 20 years Roberts served as chief engineer and consulting engineer on various railroads and canals. This was the period of the battle of the gages, and in the early years it seemed probable that the 6-ft gage would become standard. James Pugh Kirkwood, it will be recalled, held out for the broad gage as late as 1854. Roberts strongly advocated the narrower (4-ft $8^{1}/_{2}$-in.) gage, however, and was instrumental in establishing it as the standard, east of the Mississippi River, at a somewhat earlier date.

Space does not permit a detailed account of these 20 years. Roberts' energy and capacity for work must have been prodigious, and his services almost universally in demand. He traversed large tracts of country on horseback—30 to 40 miles a day, and on one occasion 68—writing and working as he rode, and far into the night. It should be mentioned, however, that he built two of the earliest railroads west of the Mississippi—the Keokuk, Des Moines and Minnesota, and the Keokuk, Mt. Pleasant and Muscatine.

Roberts was one of the first American engineers to have an important part in the internal development of a foreign country. In May of 1858, "in company with five other gentlemen, all of the United States," he closed the contract, in Rio de Janeiro, Brazil, with the Don Pedro Segundo railway company for the construction of their road.

That road is generally regarded as the most difficult and expensive railway of the period. It passed northwestward from Rio, over the Sierras, to tap the Parahyba Valley in the province of Minas Geraes. The rough topography involved a large amount of heavy work—deep cuts through granite, and very high fills. In one section there were 13 tunnels in 9 miles, one of them 7,200 ft long.

The employment of American engineers on the Don Pedro Segundo is of especial interest, for the road was backed by English capital, and the first 50 miles, leading to the foot of the mountains, had actually been built by English engineers and contractors.

On the mountain division, grades of 95 ft to the mile and 8-deg curves were necessary. The English locomotives did not prove adaptable to such requirements; their wide-coupled bearings caused them to stick or jump the track on the curves. Roberts was successful in replacing them with American-built rolling stock. He also introduced the "American system" of construction, which resulted in the road's being completed at a 25 per cent saving in cost.

Roberts returned to the States in 1865. In 1869 he was selected by Jay Cooke to be chief engineer of the Northern Pacific, a position he retained for 10 years. He and his party made a reconnaissance of the Puget Sound region, and passing over the mountains, laid out the route as far eastward as Fort Benton and the mouth of the Yellowstone. Although then 60 years of age, Roberts' physique enabled him to endure the hardships of this exploration with ease. A companion on the journey later remarked: "He was the only man I ever saw write continuously in the saddle. I believe he wrote from Walla Walla to Missoula."

The bursting of Cooke's railroad bubble in 1873 tied up operations on the Northern Pacific as well as on most other roads. By that time the line had been constructed westward from Lake Superior as far as Bismarck, N.Dak. When the work was later resumed, Roberts was still in charge. The last spike, however, was not driven until two years after his death.

Thus far we have touched on but one side of Roberts' career. Although the greater part of his life was devoted to railroads, he looked upon them as but one unit of an integrated transporation system that included inland waterways as an important factor, and he had an important influence on the development for navigation of both the Ohio and the Mississippi rivers. "In many cases," he once said facetiously, "railroads have been made to supersede canals, which, as an old canal engineer, I think was naughty." More seriously, he added that they would never supersede navigable rivers. "In fact," he said, "the prime mission of railroads everywhere is to bring freight of all kinds to navigable waters, in order that it may be transported thereon at cheaper rates . . . . The farther inland upon this continent we can extend deep navigation for ocean-going vessels, the better for the world's commerce."

From 1866 to 1870 he was the United States civil engineer in charge of improvement of navigation on the Ohio River. For some years previous to that, however, he had been much interested in the project. As early as 1839 he had recommended the improvement of the Ohio by means of a series of locks and dams—just about a half century before the first of the present series was built. In 1849 Charles Ellet, Jr., evolved the idea of flood control and navigation improvement by headwater storage, and a few years later he began a serious attack on the proposal of locks and dams. Roberts felt that the criticism was unfair, and took Ellet severely to task in a strong rejoinder. He pointed out the tremendous cost of Ellet's plan, and as well, the impracticability of reconciling the conflicting requirements of flood control and navigation in reservoirs of the size available. Roberts' advocacy of the canal system had much to do with its final adoption, though the first lock and dam of the Ohio system (at Davis Island, a few miles below Pittsburgh) was not completed until 1885, four years after his death.

For some 60 years Captain Eads' jetties at the mouth of the Mississippi River have performed their work so efficiently that it is now somewhat amusing to think of ocean-going vessels being locked through a canal to reach the port of New Orleans. But an official recommendation for improving the mouth by canalization was made in 1838, fourteen years before the jetty system was first proposed; and when Congress took up the question seriously in 1871, canalization was the favored method. The Secretary of War was instructed to make surveys and estimates for a canal, with locks. Of a board of engineers appointed to study the question two years later, only one member recommended jetties in preference to that system.

Fortunately the investigation did not end there. In 1874 President Grant appointed a second commission, of which Roberts was an influential member. He and his associates spent considerable time in examining the works already installed on foreign rivers—notably the Nile, the Danube, and the Maas—and it was on their recommendation that the jetty plan was finally adopted. Captain Eads undertook the work the same year, and Roberts remained on the project in an advisory capacity.

In 1879 Roberts returned to Brazil, at the personal invitation of the emperor, to become engineer for the government on all public works. In the course of his duties he set out in 1881 on an inspection of the Rio das Valhas. Near Soledade, in the province of Minas Geraes, he contracted typhoid, and his death occurred at that settlement on July 14. His body was later removed to Philadelphia and re-interred in Woodlands Cemetery.

So much for the works—what of the man himself? It is said of Roberts that he was not much given to the study of books—his method of learning was to observe acutely and make voluminous notes. Moreover, he was not particularly impressed with mathematical theories and formulas. In connection with a problem in river hydraulics he remarked on one occasion that the "nice mathematical theories" of threads of water, waves of translation, and so forth, were well enough in their proper places, "but if a man has all these . . . at his finger end, and has not practical experience in the actual operation on a large scale of water in rivers and canals, his judgment might easily be at fault" in planning river works. "Gravity," he added, "being the father of the whole thing, . . . looks carefully after all his children. It is curious how simple things may be made mysterious." Roberts, however, was not narrow minded, or prejudiced against "theory," and it is said that he was a welcome associate of many distinguished theoreticians in the practice of engineering science.

The writer of his Memoir (in TRANSACTIONS, Vol. 36, pp. 531 et seq.) calls attention to his "untiring energy and extreme devotion to the work of the moment," and states that he was fond of physical sports, being an excellent skater and a skilled horseman. He was also "eminently social." His letters and speeches were witty and cheerful. "He was a most genial companion, in fact he was the cheery life of the assemblages of which he was a part. He had a bright sense of humor, and a constant fund of stories of his varied experiences."

The photograph accompanying this article is from a handsome memorial volume that was prepared at considerable cost by the Engineers' Club of Rio de Janeiro and presented to the Society at the time of Roberts' death. Quotations not otherwise identified are from papers and addresses by Roberts in the publications of the Society.

THE DON PEDRO SEGUNDO RAILROAD, IN BRAZIL, WAS AN OUTSTANDING ENGINEERING ACHIEVEMENT OF THE 1860's

This View Shows One of the Bridges of the Mountain Division

E.C.P.D. Committee Reports on Professional Recognition

Progress Has Been Made in Correlating Methods for Formal Recognition of an Engineer's Development

At the fourth annual meeting of the Engineers' Council for Professional Development, held in New York on October 6, 1936, the Committee on Professional Recognition, among others, made a tentative annual report. Council voted to accept this report but to defer adoption of the recommendations contained therein until its next proposed meeting (to be held within the following six months), when it should receive first consideration. For the information of members the complete report of the committee is appended.

Tentative Annual Report of Committee on Professional Recognition

To the Committee on Professional Recognition is assigned the fourth phase of the E.C.P.D. program, namely, to develop procedure and recommendations for "bringing some correlation into the various methods of formal recognition of the development of an engineer" (1935 Report of E.C.P.D., page 3).

The present avenues or stages of formal recognition of the development of an engineer are three in number. They are all represented in E.C.P.D. as a coordinating agency. Listed in order of progressive and chronological sequence, they are:

1. *Professional education,* as evidenced generally by graduation from an approved college of engineering.
2. *Registration as a professional engineer,* representing legal recognition and admission into the engineering profession.
3. *Membership in a professional grade of a recognized engineering society,* representing recognition of the attainments of the individual by his fellow engineers.

These three stages of formal recognition of the development of an engineer are now established. Our problem is to improve their correlation.

The proposal of any additional procedure of certification or recognition would only be adding a fourth method to the three methods of progressive recognition already established. It would introduce new competition or conflict and new difficulties of correlation, and would therefore not be a solution of the problem of harmonious coordination.

It is true that the three methods of progressive recognition already established are not yet, within themselves, sufficiently uniform. With equal interest in all three, E.C.P.D. should address itself to achieving results of more uniform significance. Nothing in this report is to be construed as recommending any lowering of present standards or requirements.

1. Under the heading of *Professional Education,* E.C.P.D. (through its Committee on Engineering Schools) is seeking to establish recognized national standards of quality and attainment for engineering schools through its program of accrediting. "Graduation from an approved course in engineering" should eventually have a more definite and more uniform significance.

2. Under the heading of *Engineers' Registration,* it is recognized that this method of formal recognition is not yet universal nor sufficiently uniform. Only 35 of the 48 states have engineers' registration laws; and in three of these states the laws are incomplete, covering only a fraction of the profession. Moreover, with such laws enacted at different dates (since 1907) and under varying circumstances, there are naturally some variations in their qualification requirements. "E.C.P.D. should therefore address itself to rendering all possible assistance to effect uniform registration laws in states which do not have them, to improving the registration laws that now exist, and to effecting among these present laws a higher degree of uniformity as to requirements and as to form of recognition" (1935 Report of Committee on Professional Recognition, adopted by E.C.P.D. October 8, 1935).

3. Under the heading of *Membership in Engineering Societies,* it is recognized that there is considerable variation in qualification requirements for admission to the same or corresponding grades of membership in the various national organizations. Significance and recognition will be advanced if these requirements are brought to a more uniform level, both in constitutional prescription and in application. E.C.P.D. has adopted the recommendations of this committee (1933 and 1934) for "Standard Grades of Membership," namely, Student Member, Junior Member, Member, and Fellow; and support should be given to the establishment of this uniform system of grades upon the basis of the advantages to the entire engineering profession resulting from more uniform formal recognition. E.C.P.D. has also adopted the "Minimum Definition of an Engineer" formulated by this committee (1933); and under the approved "Standard Grades of Membership," the grade of Member is defined as "the full-fledged engineer, that is, the engineer who has passed the requirements in the minimum definition of an engineer." All of the interested engineering societies should therefore be urged to make the "Minimum Definition of an Engineer" their goal as a minimum requirement for admission to the Member grade. The Minimum definition prescribes professional education, specified experience, and the passing of written examinations. Instead of duplicating such examinations, the engineering societies may accept the results of corresponding examinations, passed in securing professional registration under the state laws.

Correlation

If the three avenues or stages of recognition of development of an engineer (1. Education, 2. Registration, 3. Membership) are appreciated as logically progressive and successive, much apparent conflict is resolved, and consistent correlated relationship is made manifest. The Committee on Student Selection and Guidance has for its province the problems preceding and anticipatory to Phase 1; the Committee on Engineering Schools covers Phase 1; the Committee on Professional Training is chiefly concerned with the problems covering the period of individual development between Phase 1 and Phase 2, and beyond; and the Committee on Professional Recognition is concerned with all as they are related to the recognition of the engineer.

Under the concept of the progressive sequence of the three stages of recognition (1. Education, 2. Registration, 3. Membership) each successive stage should be predicated, so far as practicable, upon the prior attainment or completion of the stage preceding it. Thus will any remaining conflict be minimized, and correlation improved.

Accordingly, evidence of completion of (1) professional education (by graduation and/or examinations) should be made universally a prerequisite for (2) registration under the state laws and for (3) admission to Member grade in the national engineering societies. E. C. P. D. should therefore give its assistance in amending any state registration law in which evidence of professional education (by graduation and/or examinations) is not yet clearly specified as an essential prerequisite. Likewise E.C.P.D. should urge all interested engineering societies to adjust their requirements so as to specify evidence of professional education (by graduation and/or examinations) as an essential prerequisite for membership.

Similarly, to improve correlation, registration should be made so far as practicable, a minimum prerequisite for admission to the professional grades of membership of the national engineering societies. Each organization can easily determine for itself which of its membership grades shall be regarded as professional. For admission to the professional grades of membership, with such temporary exceptions as may be practically indicated, state registration should be established as a minimum requirement. This does not mean that any candidate is to be accepted for membership merely because he is registered or licensed. The engineering society may not yet be satisfied with the qualification requirements for registration in some of the states, and may desire therefore to impose such additional requirements as it deems proper.

ANNUAL MEETING of the Society, to be held in New York, N.Y., January 20–23, 1937

State registration is here recommended as a desirable basic requirement, not as an all-sufficient requirement.

Unless any engineering society takes the position that the states maintain qualification requirements higher than should be expected of professional grades membership of the society, there would appear to be no valid objection to requiring registration as a prerequisite. If, on the other hand, any engineering society takes the position that the registration requirements in any state are inferior, there would appear to be no objection to challenging any candidate who fails even to meet such inferior requirements.

TABLE I. PERCENTAGE OF MEMBERS REGISTERED AS PROFESSIONAL ENGINEERS IN 30 REGISTRATION STATES

Am.Soc.C.E.			A.S.M.E.		A.I.E.E.		A.I.M.E.		A.I.Ch.E.	
Grade	%		Grade	%	Grade	%	Grade	%	Grade	%
Assoc. M.	54	56	Members	25	Members	29	Members	13	Active M.	11
Members	56		Fellows		Fellows		Hon. M.			
Hon. M.	60		Hon. M.		Hon. M.					
Juniors	15	15	Juniors	04	Juniors	07	Juniors	02	Juniors	05
Affiliates	16		Associates		Associates		Associates		Associates	

Exceptions can of course be made for applicants from the 13 states which do not yet have registration laws, or from the 3 states in which the registration laws are incomplete. Exceptions can also be made for applicants who can show specific exemptions in their state registration laws, permitting their continued responsible practice of engineering without registration.

It is therefore recommended that the interested engineering societies consider the eventual adoption of the following requirement:

"Before admission or transfer to professional grades of membership in this society, an applicant shall show that he is or has been a legally registered professional engineer, unless he resides in a state in which an engineers' registration law has not been enacted, or unless he shows specific legal exemption under the engineers' registration law of the state in which he resides, permitting him to engage in the responsible practice of professional engineering without registration."

The adoption of this recommendation will improve correlation between membership grades and professional registration. It will also improve correlation between recognized professional status and corresponding grades of membership in the different engineering societies. It will, incidentally, facilitate the full establishment and application of the Minimum Definition of an Engineer as a requirement for admission to membership. Such coordination of (2) registration and (3) membership will improve the standards and status of both and will be a constructive contribution towards harmonious and consistent relationship of the "various methods of formal recognition of the development of an engineer."

A further contribution to the correlation and significance of formal recognition would be to simplify, towards greater uniformity, the wide variation of degrees conferred upon graduation from engineering schools and, in particular, to eliminate the professional degree (C.E., M.E., E.E., etc.) as a degree in course. For perfect correlation, E.C.P.D. should recommend that these professional degrees, if conferred at all, be not conferred by the engineering schools upon any graduate before he has passed the stage of professional registration. Again, registration should be regarded as a necessary, though not as a sufficient prerequisite. Each individual school may impose such additional requirements and tests as it deems appropriate.

SURVEY OF PRESENT CORRELATION

In order to establish an index of the present degree of correlation between (2) state registration and (3) society membership, a survey has been prepared under the auspices of E.C.P.D. at the request of the Committee on Professional Recognition. This survey, in summary form, yields the percentages of correlation given in Table I.

The complete report of this count, by states, of the relative number of members registered under the state laws in each grade of membership in each of the five participating engineering societies, is submitted as an appendix* to this report. These data are also shown in graphic form for New York, for Iowa, and for 30 states for which registration figures were available.

The percentages of correlation found in this survey are higher than was generally anticipated. They are higher for some of the societies than for others. By this survey, a clear line of differentiation is indicated between the professional grades and the other grades.

An improvement in the indicated percentages of correlation is to be desired for advancing the recognition of the profession. The development of recommendations for the improvement of such correlation is a phase of the E.C.P.D. program assigned to the Committee on Professional Recognition.

SUMMARY OF RECOMMENDATIONS

1. E.C.P.D. should urge upon its participating engineering societies the actual adoption and application of the "Minimum Definition of an Engineer" as a minimum requirement for admission to membership. Evidence of professional education (by graduation and/or examinations) should be specifically included in the prescribed membership qualifications.

2. E.C.P.D. should urge and encourage the early adjustment of membership grades in the participating engineering societies to conform to the "Standard Grades of Membership" previously formulated and ratified.

3. E.C.P.D. and its participating bodies should render all possible assistance to effect uniform registration laws in states which do not have them, to improve and to strengthen the registration laws where they now exist, and to effect among these present laws a higher degree of uniformity as to requirements and as to form of recognition.

4. E.C.P.D. should give its assistance and support in amending any state registration law in which evidence of professional education (by graduation and/or examinations) is not yet clearly specified as an essential prerequisite.

5. E.C.P.D. should recommend to all participating and interested engineering societies that state registration of a candidate be established as a minimum prerequisite for admission to professional grades of membership, with such provisional exceptions as present circumstances may justify.

6. E.C.P.D. should urge and support the simplification, towards greater uniformity, of the wide variations of degrees conferred upon graduation from engineering schools.

7. E.C.P.D. should recommend to all engineering schools that the professional degree be eliminated as a degree in course; and that (when it is awarded for post-collegiate professional recognition) it be not conferred until after the candidate has secured professional registration as a minimum prerequisite.

Respectfully submitted,

C. N. LAUER, *Chairman*
J. W. BARKER
H. C. PARMELEE
D. B. STEINMAN
F. M. BECKET
F. L. BISHOP
(H. S. ROGERS, *Alternate*)
J. P. H. PERRY
Committee on Professional Recognition

October 1936

United Engineering Trustees Elects Officers

AT ITS recent annual meeting, George L. Knight was reelected president of the United Engineering Trustees, Inc., joint agency of the four Founder Engineering Societies. Otis E. Hovey and D. Robert Yarnall were named vice-presidents. John H. R. Arms, general manager of the United Engineering Trustees, continues as secretary; Albert Roberts was reelected treasurer; and H. R. Woodrow assistant treasurer. The following trustees were reelected: John P. Hogan, Henry A. Lardner, Mr. Yarnall, and Mr. Woodrow. Holdover trustees are H. P. Charlesworth, H. G. Moulton, J. P. H. Perry, A. L. J. Queneau, and Walter Rautenstrauch. Of the above list, Messrs. Hovey, Hogan, Moulton, and Perry are members of the Society.

Founded in 1904, the United Engineering Trustees, Inc., administers properties valued at $4,000,000, consisting of the Engineering Societies Building, the Engineering Societies Library, and the Engineering Foundation. The latter was founded in 1914 by Ambrose Swasey, Honorary Member of the Society, "for the furtherance of research in science and engineering, or for the advancement in any other manner of the profession of engineering and the good of mankind," through the use of income from endowment funds which the United Engineering Trustees holds jointly for the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers.

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* *Editors Note: The appendix is not included here.*

The United Engineering Trustees was established by charter "to advance the engineering arts and sciences in all their branches, to further research in science and engineering, to maintain a free public engineering library, and to advance in any other manner the profession of engineering and the good of mankind." Through the Engineering Foundation, the Library Board, and the Administrative Department, it aids research in engineering and the sciences, operates the Engineering Societies Library—the largest strictly engineering library in America—and carries on numerous other activities.

International Standard Letter Symbols—a Technical Esperanto

The standardization of the symbols used by technical writers is important in so far as it tends to make the reading of technical papers easier. At its worst a letter symbol is an abbreviation that is indispensable to the writer. At its best it can be made infinitely valuable to the reader. The barrier to progress in this field is the writer who establishes a list of symbols for his paper without taking serious account of precedent or popular preference. Those who read his work are impeded from a smooth intake of logic by the staccato interjection of strange letters with meanings foreign to all current experience. The mental labor required simply to carry unaccustomed nomenclature in mind is often severe enough to keep a valuable idea suppressed for years.

On September 14 and 15, at Society Headquarters, there was an informal international conference on letter symbols on heat and thermodynamics which was significant in a broad sense because it demonstrated the intensity of interest that can be aroused in this subject. It was a conference to establish a kind of technical "Esperanto." The following organizations were represented: Comité Electro-technique Suisse, British Standards Institution, Association Française de Normalisation, Ausschuss für Einheiten und Formelgrössen (of Germany), Verein Deutscher Ingenieure, Institution of Gas Engineers (of England), Comité Electrotechnique Français, International Congress of Refrigeration, The Physical Society (of England), National Research Council of Canada, Institution of Heating and Ventilating Engineers (of England), Institution of Mechanical Engineers (of England), Chemical Society (of England), and the Polish Society of Mechanical Engineers. The American interests were represented by the American Standards Association's Subcommittee on Symbols for Heat and Thermodynamics. The total attendance at the conference was 42.

The feature of this meeting that should interest civil engineers was the acceptance of the following list of basic rules to control future standardization:

"1. An author should realize that before his readers can begin to understand his subject matter they must master his symbols. Therefore, it is worth considerable effort to transmit to the reader a convenient and easily understood set of these symbols.

"2. The symbols here considered are letters, or letters affected with subscripts or superscripts, used to represent numerical values in mathematical formulas. They do not include chemical symbols, those used in spectroscopy, or abbreviations, which are shortened words used in text or tables, and which should not be used in formulas.

"3. A symbol for a single concept should be a single character, with or without subscripts. Two or more characters together of equal rank usually denote a product. It is desirable to slightly separate such terms of a product to distinguish them from such entities as dx, sin, tan, etc. Similarly a subscript is always to be a single character, unless there is reference to two states or the like according to Rules 13 and 14.

"4. In order to increase the clarity of printed matter, which is practically always roman, letter symbols alone or in equations or as subscripts, should be printed in italics, for both capital and small letters. Numbers in formulas or as subscripts or exponents should be roman.

"5. A complete table of the symbols used in a book, article, or paper should be given, preferably at the beginning, where it will be certain to strike the reader's attention. If the symbols are wholly or largely given in an officially adopted list, this will, of course, be mentioned. These lists are not yet widely enough circulated to warrant omission of the author's list. Such a table will eliminate the very poor practice of defining an often used symbol only in the text the first time it is used, which compels a reader to search through the text time after time to find the meaning of each symbol, when he is going over equations. However, if a symbol is used once only, and never referred to again, it is proper to define it in the text at the one place when it is used, so as not to burden the table of symbols. On the other hand, all symbols used more than once should be given in the table of symbols. They need not be alluded to in the text at all. However, even with a table, there is advantage with definition at first use. Then the table should be alphabetical.

"6. The symbols of that one of the various officially adopted lists which is nearest to the general subject of a given text, should be used. Of course, it will often occur that an author will need symbols not in this list, and then search must be made of related lists. If no list contains a desired symbol, a symbol of a related concept may be used with a subscript. If this is not possible, a new symbol must be selected, naturally following whatever current practice may exist.

"7. When in a given discussion, different concepts from one or more lists of symbols have the same symbol without alternatives, this symbol preferably should be used for each concept. If there is any possibility of confusion, there should be added subscripts, selected by the author, in all cases or all but one case. If there is only one use of a symbol in a paper, a subscript of an officially adopted list may be omitted.

"8. Various quantities related to a concept for which a symbol is given in a list, are to be denoted by the given symbol, with subscripts, usually to be selected by the author. For example, various diameters are to be denoted by D_1, D_2, D_a, D_b, etc.

"9. The same symbol should be used for a given concept, regardless of the number of special values which occur, and subscripts or superscripts should be used to designate special values.

"10. Superscripts may be $'$, $''$, $'''$ or other signs of such nature as to avoid any chance of confusion with exponents. They should be used sparingly.

"11. The same symbol should be used for a given concept regardless of units. For example, v is specific volume, whether in cc per gram, cc per mol, or cu ft per lb.

"12. In cases where more than one system of units is used in a discussion, a single symbol should be used, with addition of subscripts or superscripts, to denote units other than the primary one. For example, p, p_0, p', p''.

"13. Letter subscripts should be used to denote values under special conditions or in special states. A subscript consisting of two letters (usually not to be separated by a comma) denotes a value or a change of value between two conditions or states.

"14. Numerical subscripts should be used to denote values at designated points in an apparatus, process, or cycle. A subscript consisting of two numbers (usually not to be separated by a comma) denotes a value or a change of value between two points, sometimes requiring specification of path.

"15. Where possible, capital letters should denote total quantities and small letters should denote specific quantities, or quantities per unit. For example, S may be entropy of any mass, and s may be entropy of unit mass. Sometimes in papers on similitude, capital letters apply to the model and small letters to the prototype."

This development of basic principles for future guidance was, perhaps, the most forward-looking and constructive work of the conference. In its finished form it can well be adopted as a fundamental "platform" for the use of all technical groups.

American Engineering Council

The Washington Embassy for Engineers, the National Representative of a Large Number of National, State, and Local Engineering Societies Located in 40 States

TREASURY Emergency Construction's projects allocated under the $60,000,000 program, Act of June 22, 1936, were reported, as of October 6, 1936, to total 372 in number. They involve an expenditure of $56,896,000. The $60,000,000 program, under the Act of August 12, 1935, is still in progress, and only $12,769,467 of the $65,000,000 program, under the Act of June 19, 1934, has reached completion. None of these figures includes administration.

Bureau of Public Roads' summary for the year ending June 30, 1936, shows contracts awarded for 22,300 miles, at a cost of $489,000,000, of which $393,000,000 was to be supplied by federal government agencies. At the end of the year, 1,240 grade eliminations were under contract—most of them under construction—and 168 elimination structures were under contract for reconstruction. Over $500,000,000 was allocated from the Emergency Relief Appropriation Act of 1935 for such work. Directly and indirectly, highway work administered by the Bureau is said to have supported more than one million people.

An interesting recent report by the Bureau states that highways are now being designed for the safe accommodation of vehicles moving at rates of speed up to 60 miles. This applies to new highways and to the improvement of a large mileage of the older highways being undertaken by successive stages. Other improvements adding to safety at the higher speeds include a general widening of road surfaces; the complete separation of lanes for opposing traffic where a density of traffic requires more than two lanes; the elimination of the more dangerous railroad crossings; the provision of by-pass routes around towns and cities; and the improvement of routes of direct access to the centers of cities.

Improvement of roadsides by landscaping, grading, seeding, sodding, and planting is becoming increasingly popular and the Bureau of Public Roads reports over 5,000 miles of highway improved, according to plans by landscaping specialists, at a total cost of more than $7,000,000. The earlier overemphasis on particular kinds of planting and landscaping is being balanced with the saving of trees and other forms of natural beauty, and with the elimination of borrow pits and better clean-up after construction. Diversions of taxes paid by road users and motor carriers to "other than highway purposes" are reported to have amounted to $146,449,711 in 1935, an increase of more than $24,000,000 over similar diversions in 1934. The larger amounts went into general state, county, and municipal funds, but substantial diversions were made to many remotely related activities.

Social Security Board released a statement on October 26, 1936, regarding its present plan of operations. It is the shortest and simplest statement of its objectives yet to come to our attention. Copies may be obtained from the Social Security Board Press Service, Room 408, 1712 G Street, N.W., Washington, D.C.

CIVILIAN CONSERVATION CORPS DEVELOPMENTS

Civilian Conservation Corps announced an executive order on October 29, 1936, providing for one junior assistant to the chief technician in each camp—a newly created Civil Service job, only open to Civilian Conservation Corps enrollees. In anticipation of such opportunities, the Civil Service Commission conducted competitive examinations in CCC camps last summer, and approximately 15,000 enrollees were found eligible. The position pays $85 per month, and successful candidates become members of their camp supervisory or administrative forces.

In a letter addressed to the President, on October 24, 1936, Director Robert Fechner of the Emergency Relief Conservation Work, urged the President to make the Civilian Conservation Corps a permanent organization, with a Corps of 300,000 to 350,000. He expressed the belief that such an organization was essential to public welfare, and cited the tremendous need for reforestation, erosion control, conservation, and rehabilitation, having as their objectives the further improvement of our natural resources.

Works Progress Administration has allotted $5,500,000 to the Engineers Corps of the Army to cover the cost of making flood control studies authorized by the last Congress. Being work relief funds, the WPA allotment carries relief restrictions to employment and compensation, leading to difficulties in the mobilization of engineering forces.

The Army's efforts to put this program into execution are creating a great many opportunities for engineers to work, but unfortunately the relief restrictions keep most of them in the subprofessional classification. In other words, present interpretations of the law enacted by Congress forbid the use of the funds made available for the employment of all people except those who are out of work or forced to accept relief work.

National Resources Committee advises that it is approaching the release date for preliminary reports on surveys of the principal drainage basins of the United States. This information is expected to be of interest and assistance to engineers and citizens interested in soil and water conservation and the better utilization of natural resources without state boundary restrictions.

The survey of the needs of the several political subdivisions for public works for a period of six years, which is being made by the National Resources Committee at the request of Secretary Ickes, with the cooperation of state planning boards, is reported to be making considerable progress. Engineers are, therefore, again urged to interest themselves in the preparation of such estimates for public works by local officials and sponsoring agencies.

Public Works Administration releases for October carry an announcement of new loans and grants of several hundred projects in thirty-odd states. Allotments have been made since July 1, 1936, on more than 1,500 projects, estimated to cost $235,957,909

Massachusetts State Highway Department

Superhighway with Separated Roadways, Between Southboro and Worcester, Mass.

Montana State Highway Department

Highway-Railway Grade Separation on U. S. Route 10, East of Bozeman, Mont.

EXAMPLES OF MODERN HIGHWAYS IMPROVED WITH THE AID OF FEDERAL FUNDS, AS REPORTED BY U. S. BUREAU OF PUBLIC ROADS

Almost $200,000,000 is still available for future loans and grants to political subdivisions willing to provide 45 per cent of the cost.

Only 6.25 per cent of current grants by the Public Works Administration involve loans in comparison with almost 50 per cent on earlier allotments. This change is said to be due to the fact that applicants have discovered that it is to their advantage to sell their securities to private investors, offering higher rates of interest than the Public Works Administration.

The current issue of the Bureau of Labor Statistics carries an interesting analysis of Public Works Administration activities. It shows that 65 per cent of the total disbursements on construction projects went for materials and 35 per cent for labor on the site. The advance figures show increases in industrial employment ranging from 14.2 per cent to as much as 225.4 per cent for the life of the Public Works Administration.

The F. W. Dodge Corporation reports for the first nine months of 1936 in three states east of the Rockies show publicly undertaken construction amounting to $1,061,452,300 in comparison with $579,525,300 for the first nine months of 1935. It also states that while public construction fell below private construction in September for the first time since May 1936, it is still 83 per cent ahead of 1935. Private construction is reported to be about 60 per cent ahead of 1935.

The President's Committee on Government Reorganization seems to be concentrating its efforts on a confidential study of government management and personnel problems. Confidential personal reports to the President are said to carry recommendations for the establishment of a "Career Service," patterned after the British Career System, to take the place of the present mixture of Civil Service and emergency and unclassified employees depending upon patronage. Such a system would include administrative, professional, clerical, skilled, semi-skilled, and unskilled employees. The plan suggested provides that new employees would undergo a period of probation, after which they would become members of the Career Service, removable only for cause. Vacancies in the better jobs would be filled by promotions from the lower classifications on the basis of capabilities.

As soon as the real intent of the report can be determined, Council's organization will exert its full influence for a merit system free from social and political control and bias.

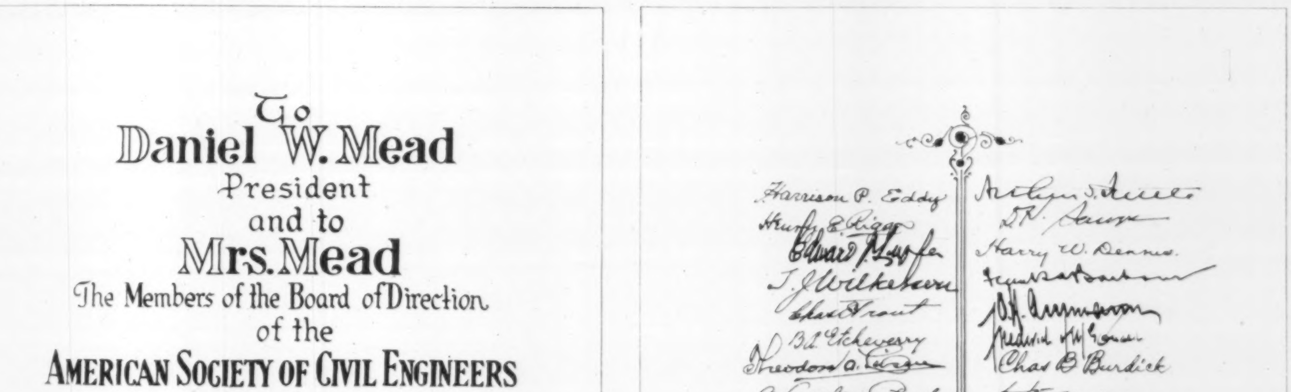
Washington, D.C.
November 15, 1936

Swasey Awarded Hoover Medal

On Wednesday evening, December 2, 1936, Ambrose Swasey, Hon. M. Am. Soc. C.E., founder of the Engineering Foundation, will have the high distinction of becoming the second recipient of the Hoover Gold Medal. The occasion will be the annual dinner of the American Society of Mechanical Engineers, of which Mr. Swasey is past-president and honorary member, to be held at the Hotel Astor, New York, N.Y. Mr. Swasey will be ninety years old at about this time, and the celebration will give some attention to that anniversary.

The Hoover Gold Medal was instituted to commemorate the civic and humanitarian achievements of Herbert Hoover, and the first award was made to him in Washington, D.C., in April 1930. Inscribed on the medal is the legend, "Awarded by Engineers to a Fellow Engineer for Distinguished Service." The trust fund creating the award is the gift of Conrad N. Lauer, of Philadelphia, a former president of the American Society of Mechanical Engineers. It is held by that society and is administered by a board of award consisting of representatives of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers. Society representatives on the board which selected Mr. Swasey are Ralph Budd, Albert S. Crane, and Thaddeus Merriman, all Members Am. Soc. C.E.

The Society's official representative at the presentation of the award to Mr. Swasey will be Robert Ridgway, Past-President Am. Soc. C.E. Members of the Society are cordially invited to attend the banquet.



To
Daniel W. Mead
President
and to
Mrs. Mead
The Members of the Board of Direction
of the
AMERICAN SOCIETY OF CIVIL ENGINEERS
hereby express
best wishes for long life and
continued happiness upon
the occasion of your
GOLDEN WEDDING ANNIVERSARY

November 30, 1936.

Harrison P. Eddy
Henry E. Riggs
Edward P. Lupfer
T. J. Wilkerson
B. A. Etcheverry
A. Arthur Poole
Herman Stabler.
Ivan C. Crawford.
R. A. Hill
Carlton S. Proctor.

Arthur S. Tuttle
Harry W. Dennis.
Chas B. Burdick
H. S. Morse
Jas. L. Ferebee
E. P. Arneson
Otis E. Hovey
George T. Seabury

Congratulations to Dr. and Mrs. Mead on the Occasion of Their Fiftieth Wedding Anniversary

Facsimile of Two Pages from a Hand-Lettered and Illuminated Memorial Presented to Them by the Members of the Board of Direction. The Book Is Bound in Blue Leather, Edged with Gold; a Society Pin, Engraved on the Reverse in the Usual Way with Dr. Mead's Name and Honorary Membership Serial Number, Is Set in the Front Cover

Preview of Proceedings

By HAROLD T. LARSEN, *Editor*

The three main papers in the December issue of "Proceedings" will deal with the construction and testing of hydraulic models, stresses in tunnel tubes, and the pure theory of structural analysis. An important progress report of the Sanitary Engineering Division of the Society is also offered for discussion.

CONSTRUCTION AND TESTING OF HYDRAULIC MODELS, MUSKINGUM PROJECT

The paper entitled "Construction and Testing of Hydraulic Models, Muskingum Project," by George E. Barnes, M. Am. Soc. C.E., and J. G. Jobes, Jun. Am. Soc. C.E., was originally scheduled for the November number of PROCEEDINGS. Last-minute adjustments, however, made it seem advisable to defer publication until the December issue. A short description of this paper was given in the November "Preview of Proceedings."

ANALYSIS OF STRESSES IN SUBAQUEOUS TUNNEL TUBES

In a paper entitled "Analysis of Stresses in Subaqueous Tunnel Tubes," A. A. Eremin, Assoc. M. Am. Soc. C.E., has utilized Maxwell's reciprocal theorem to evolve a system of analyzing stresses in a circular tunnel section with tie rods. The analytical work necessary in order to adapt Maxwell's theorem to the solution of this problem is given in detail, including one numerical example. This paper expresses the mechanics of solving a special practical problem not readily found in textbooks or engineering literature.

DEFLECTION BY GEOMETRY

A stimulating paper on "Deflection by Geometry" is being presented in the December issue by David B. Hall, Assoc. M. Am. Soc. C.E. This paper is ingenious in its treatment of the subject, and it is expected that the method suggested will prove practicable. Mr. Hall presents one basic idea and discusses that central idea instead of giving a long series of varied examples. There are, however, discussions of four problems and three formal theorems. Although this paper is brief, it presents a subject worthy of detailed study by designers.

FILTER SANDS FOR WATER PURIFICATION PLANTS

Since 1925, the Committee of the Sanitary Engineering Division on Filtering Materials for Water and Sewage Works has been engaged in developing methods for selecting and testing filter-bed materials for water-works and sewage-disposal plants. The Committee has presented a comprehensive progress report covering its work on one part of its assignment—filter sands for water purification plants, which it is hoped may be included in the December issue.

EXPERIMENTAL FILTERS, KANSAS CITY (MO.) WATER DEPARTMENT

Sixteen cities cooperated in constructing and operating batteries of experimental filters, using various sizes of sand supplied by James W. Armstrong, M. Am. Soc. C.E., a member of the Committee. The tests were directed primarily to determining, for each size of sand, the ability of the bed to prevent the passage of floc; the length of run and the effect of temperature thereon; and the best rate of applying wash water. Secondary data were collected on such factors as the depth of penetration of floc in sands of various sizes; the extent of hydraulic grading under the action of wash water; and the relations between sand size, velocity and temperature of wash water, and sand rise. All this work has been carefully correlated, and is presented in graphical form so far as possible. In an appendix to the report, the experimental apparatus and technique are thoroughly described.

The report also presents a method for determining the proper depth of a filter bed when the mechanical analysis of the sand composing it is known. Preliminary tests have given evidence of its feasibility and suggest an interesting field for further research.

The Committee consists of W. E. Stanley, chairman, Mr. Armstrong, W. H. Dittoe, G. B. Gascoigne, and N. T. Veatch, Jr., all members of the Society.

DISCUSSIONS

Unusual interest, indicated by active discussion of current papers, has been shown in PROCEEDINGS during the latter part of this year. The closing remarks of the paper by Tung Yen Lin, Jun. Am. Soc. C.E., entitled "A Direct Method of Moment Distribution," will appear in December. This paper was published in the December 1934 PROCEEDINGS and was actively discussed in subsequent months.

The current index, an annual feature of the December issue of PROCEEDINGS, is included in the forthcoming number, of course, thus marking the end of Volume 60 in this series.

Appointments of Junior Correspondents Continue

DURING the summer and fall months, 24 Juniors in various parts of the country have been added to CIVIL ENGINEERING'S list of junior correspondents. Those appointed since June 12, and the Local Sections they represent, include the following:

LOCAL SECTION	JUNIOR CORRESPONDENT
Arizona	L. O. Fiscel
Central Illinois	W. Leighton Collins
Cleveland	Roy G. Harley
Florida	S. A. Berkowitz
	W. E. Dean, Jr.
	Carl E. Johnson
	J. W. Kuhnel
	K. W. Prest
New Mexico	J. O. Joerns
Philadelphia	Stanley E. Kappe
	John B. Letherbury
	John G. Smith, Jr.
	A. Harry Wagner
	Charles W. Yader
San Francisco	Douglas H. Burnett
Spokane	A. S. Janssen
	Lavern J. Willie
Tennessee Valley	Thomas J. Harton
	George C. White
Texas	John H. Bringhurst, Jr.
	Stephen G. Endress
	Grover Green
	F. H. Martin
	J. Neils Thompson

Sixteen earlier appointees were listed in the July issue.

The junior correspondents have been responsible for a number of interesting contributions to CIVIL ENGINEERING. They have aided greatly in keeping the "News of Engineers" section up to date, and in certain Local Sections the duty of reporting Section activities has largely been turned over to them. Several have contributed "Items of Interest." One correspondent secured an interesting "Engineers' Notebook" item, assisted in its preparation, and took the photographs with which it was illustrated.

At least one Section has found a use for its correspondent not directly connected with Civil Engineering. On the occasion of a recent important meeting, the correspondent assisted the regular publicity man in preparing advance releases for newspapers. He was also assigned to contact and assist reporters during the meeting. The combined efforts of the two men resulted in a number of well-prepared stories in several papers of wide circulation.

To aid the correspondents in their work, a "Guide," or manual of instructions and suggestions, was recently prepared at Society Headquarters. Additional copies of the "Guide" have been sent to the presidents and secretaries of all Local Sections, with the thought that some of the Sections that have not yet appointed junior correspondents may find it desirable to do so after studying the plan in detail.

Index for 1936 in This Issue

At the very end of this number will be found an index for the current Volume 6 of Civil Engineering, covering the issues from January through December 1936.

To prepare such an index is a formidable task, but to have this material available for the December number, including all the papers and items of the issue in which it appears, is an even greater task. In spite of the obstacles, the Society has felt it a service due to members to make this index complete, and especially to make it available immediately. Libraries as well as engineers will appreciate the convenience and obvious advantages of this arrangement.

Also as a matter of convenience, the index has been included as a separate printed form. Thus by loosening the binding staples it may be removed intact and become available for filing or for binding in the yearly volume as desired. With this latter idea in mind, the first page of the index has been designed to make a title page for the bound volume.

Separate reprints of the index may be had from Headquarters at a cost of 15 cents a copy.

News of Local Sections

Alabama Section

The regular meeting of the Alabama Section took place at the Whitley Hotel in Montgomery, Ala., on October 2. On this occasion the technical program consisted of talks on the following subjects: "WPA Street Improvement Program in Montgomery" by Roy S. Garrett, assistant city engineer; "The Montgomery Improvement Program from the Standpoint of the WPA" by W. G. Henderson, director of District 3 of the WPA; and "The Alabama Highway Program" by H. H. Houk, chief engineer of the Alabama State Highway Department. Refreshments were enjoyed at the close of the meeting.

Central Illinois Section

On October 1 the bimonthly dinner meeting of the Central Illinois Section was held at the Southern Tea Room in Champaign, Ill. Various business matters were discussed, including the proposed plan for reorganization of the Local Sections. At the conclusion of the business session the speaker of the evening, Hardy Cross, professor of structural engineering at the University of Illinois, was introduced. Professor Cross discussed the topic, "Rugged Individualism and Planned Economy in Structural Engineering." The attendance numbered 37.

Central Ohio Section

The Central Ohio Section initiated the 1936–1937 season with its luncheon meeting held at the Chittenden Hotel in Columbus on October 8. There were 37 present to listen to the guest speaker, W. D. Turnbull, dean of the college of engineering at Ohio State University. Dean Turnbull gave an interesting account of his summer trip through the West, which covered 11,000 miles. The talk was illustrated by lantern slides, which emphasized scenic wonders as well as engineering projects.

Cleveland Section

The October meeting of the Cleveland Section took the form of a luncheon held at the Cleveland Chamber of Commerce on October 6. A résumé of the Section's activities during the past summer was presented by C. H. Splitstone, president of the Section. Then J. P. Burkey, chief engineer of bridges and railroad crossings of the Ohio State Highway Department, gave an illustrated lecture on the new Lorain Avenue—Rocky River Bridge. In this talk Mr. Burkey emphasized modernistic trends in the design of highway bridges. The meeting concluded with a discussion of plans for the Fall Meeting, led by George E. Barnes, chairman of the Section's committee on the meeting. There were 75 present. On November 10 another luncheon meeting was held, with 50 present. At this session several members reviewed outstanding features of the Fall Meeting of the Society, held in Pittsburgh. This list included George E. Barnes, head of the civil engineering department at the Case School of Applied Science; George B. Gascoigne, consulting sanitary engineer of Cleveland; F. L. Plummer and M. S. Douglas, of the civil engineering faculty of the Case School of Applied Science; John H. Anderson, contractor and engineer of Lakewood, Ohio; and George B. Sowers, consulting engineer of Cleveland, Ohio. The president of the Case School Student Chapter then discussed plans for the advancement of student activities.

Colorado Section

There were about 50 members present at the regular monthly meeting of the Colorado Section, held in Denver on October 12. After a report on the Annual Convention by F. C. Carstarphen, president of the Section, the speaker of the evening was introduced. This was Robert E. Glover, head of the mathematical research division of the U. S. Bureau of Reclamation, whose subject was "The Trial Load Method as Applied to Arch Dams." A general discussion followed Mr. Glover's talk. A special meeting of the Section was held on October 22, 1936, in honor of Harry W. Dennis, Vice-President of the Society. Mr. Dennis discussed the plans of the Board of Direction and answered many questions of policy that came up, with the object of bringing the Section and the Board more closely together. About 25 members were present.

Connecticut Section

On October 17, nine members of the Connecticut Section of the Society attended a meeting of the Connecticut Technical Council, of which the Section is a member. This meeting, which was held at Connecticut State College, consisted of a social get-together, an outing, a football game, a technical program, and a dinner in the evening. Among the speakers on the technical program were Ralph Earl, president of Worcester Polytechnic Institute; Joseph W. Alsop, chairman of the Connecticut Public Utilities Commission; and Charles F. Scott, chairman of the Connecticut Registration Board for Professional Engineers. In all, there were 182 present.

Detroit Section

The Detroit Section recently held its annual meeting at the Hotel Statler. At this session the following officers were elected for the coming year: William C. Hirn, president; Robert L. McNamee, first vice-president; Milo F. Ohr, second vice-president; and Lewis C. Wilcoxen, secretary and treasurer. The meeting was concluded with a talk by Herbert Russell, secretary of the Detroit City Plan Commission.

District of Columbia Section

At the fall meeting of the District of Columbia Section, held on October 23, C. W. Comstock gave an interesting and enlightening talk on "An American Engineer Abroad." Then D. H. Sawyer, Vice-President of the Society; Herman Stabler, Director; and Walter E. Jessup, Field Secretary, discussed the activities of the Society. In addition, A. B. McDaniel, chairman of the District of Columbia Council of Engineering and Architectural Societies, reported on the activities of the Council. There were 75 members present.

GEORGIA SECTION

A luncheon meeting of the Georgia Section was called to order at the Atlanta Athletic Club on October 12. Numerous business matters were discussed at this session, which was in charge of the Juniors of the Section. Then H. G. Mitchell, manager of the Better Business Bureau of the Atlanta Chamber of Commerce, gave a talk on his business experience during the past fifteen years, commenting particularly on frauds and fakers that have come within his observation.

INDIANA SECTION

On October 30 and 31 the Indiana Section acted as host to senior-class civil engineering students from Rose Polytechnic Institute, Purdue University, and Nôtre Dame on a two-day inspection trip to the Calumet industrial region. During the course of this trip the group was conducted through the Gary plant of the American Bridge Company; the Gary works of the Chicago-Illinois Steel Company; the new Calumet sewage-disposal plant of the Chicago Sanitary District; and the recently completed filtration and water-treatment plant in Hammond. Visits were also made to a number of grade-separation, bridge, and highway projects now under construction in the district in and around Gary and Hammond. On the evening of October 30 the members and students were dinner guests of the Portland Cement Association in Hammond. The after-dinner speaker was Robert Kingery, general manager of the Chicago Regional Planning Association, who discussed the topic, "The Chicago Regional Plan and Its Application to the Calumet Area." The attendance for the two-day meeting numbered 30 members and guests and 47 students.

ITHACA SECTION

At the annual dinner meeting of the Ithaca Section, held in Willard Straight Hall on the campus of Cornell University on October 22, the following officers were elected for the coming year: S. C. Hollister, president; E. E. Stickney, first vice-president; P. H. Underwood, second vice-president; and J. E. Perry, secretary-treasurer. Reports of the Fall Meeting of the Society, recently held in Pittsburgh, were given by Mr. Hollister and Col. W. G. Atwood.

KANSAS CITY SECTION

There were 88 members and guests present at a meeting of the Kansas City Section, which took place in the Hotel President on October 8. Members of the Section, including Robert P. Woods, the president, spoke briefly on topics of local interest. Then W. G. Fowler, structural designer for Black and Veatch, of Kansas City, discussed the Missouri state highway system. He was followed on the program by R. N. Bergendoff, assistant engineer for Ash-Howard-Needles and Tammen, of Kansas City, whose subject was "Notable Bridges in the United States." After some discussion of these papers, the program was concluded with a brief talk by J. A. L. Waddell, consulting engineer of New York City.

KANSAS STATE SECTION

A dinner meeting of the Kansas State Section was held at the Hotel Kansan in Topeka on October 5. After a brief business session the speaker of the evening, Ray Lawrence, was introduced. Mr. Lawrence, who is state engineer of PWA, gave an interesting talk on the functioning of this organization. There were 40 present, including members of the Kansas State College Student Chapter.

LOS ANGELES SECTION

The September meeting of the Los Angeles Section, which was held at the University Club, was unusually well attended. A symposium on the Los Angeles County Sanitation Districts was enjoyed at this session, the speakers being A. K. Warren, chief engineer of the districts, and A. M. Rawn, assistant chief engineer. Mr. Warren outlined the organization and administration of the districts, and the latter gave an illustrated talk on the 6-mile tunnel under Palos Verdes Mountain. On October 14 the Section met in joint session with the local branch of structural engineers to hear Dr. Charles Terzaghi, of Vienna, widely known expert on soil mechanics. Dr. Terzaghi spoke on the topic, "Settlement of Foundations on Clay," explaining his methods of strength determination, the relation of sand and clay foundations, and instruments for determining settlement. More than 250 were in attendance. Both the September and October meetings of the Junior Forum of the Los Angeles Section were devoted to the study of hydraulics. At the first, R. Stanley Lord, of the Division of Water Resources of the U. S. Geologic Survey, presented a color motion picture and short talk on the surface water supply in southern California. At the October meeting, Oliver D. Hofmann, of the Los Angeles County Flood Control District, explained ground-water explorations conducted by the district.

MARYLAND SECTION

About 75 members of the Maryland Section attended a meeting held at the Engineers' Club in Baltimore on October 29, to hear an interesting and instructive talk by Otto Kuhler, industrial designer of New York City, on "Common Sense Art in Engineering." Mr. Kuhler presented a plea for the observance of esthetic principles in the design of railroad equipment and facilities, and of the smaller products of modern industry, emphasizing particularly the material returns from attention to these principles. Salient points were illustrated by the use of slides and motion picture films. At the conclusion of the address, refreshments were served and a social hour was enjoyed. The program for the occasion was in charge of P. G. Lang, Jr., president of the Section.

METROPOLITAN SECTION

The 1936–1937 season of the Metropolitan Section opened on October 21 with a well-attended meeting, held in the Engineering Societies Building in New York City. At this session Col. Harold Fowler spoke on the subject of handling the many traffic problems incident to a great metropolis. As first deputy commissioner of the police department in charge of traffic in New York City, Colonel Fowler drew from his practical experience in discussing the feasibility of proposed solutions for traffic problems. Among the problems considered were parking, the disadvantages of a right turn on red, the lack of fast crosstown facilities, taxis, buses, the stagger system for street signals, and one-way avenues. An animated discussion followed this talk, which was heard by over 300 members of the Section and their guests.

MID-SOUTH SECTION

A two-day convention of the Mid-South Section took place at the Edwards Hotel in Jackson, Miss., on October 30 and 31. The speakers on the technical program presented at this meeting were Gerard H. Matthes, principal engineer in the office of the Mississippi River Commission, who discussed the work of the Natural Resources Committee; Nelson H. Rector, assistant state director of malaria control, whose topic was engineering phases of malaria and mosquito control; R. A. Harris, chief engineer of the Mississippi State Highway Department, who spoke on Mississippi's new forty-two million dollar highway; and T. G. Gladney, chief engineer of WPA, whose subject was "Construction Details on Some Typical WPA Projects." On the evening of October 30 there was a dinner at the Edwards Hotel, and on the 31st the group enjoyed an inspection trip to local WPA and industrial projects as well as a football game. The 1936–1937 officers of the Mid-South Section are as follows: John H. Gardiner, president; Walter F. Schulz, vice-president; and William W. Zass, secretary-treasurer.

NORTHWESTERN SECTION

There were 33 members and guests present at a meeting of the Northwestern Section held at the Minnesota Union Building in Minneapolis on October 22. During this session Lorenz G. Straub gave a report on his trip to the Fall Meeting of the Society. Another feature of the business session was the election of officers for the coming year, the results being as follows: H. K. Dougan, president; Lorenz G. Straub, first vice-president; H. S. Loeffler, second vice-president; and A. J. Duvall, secretary-treasurer. The speaker of the evening was Hibbert M. Hill, senior engineer in the U. S. Engineer Office, who reviewed the problems of design encountered in the preparation of plans for Dam No. 3 on the Mississippi River.

PHILADELPHIA SECTION

On October 21 the Philadelphia Section held its first meeting of the season. This session was attended by 100 members and guests, and there were 40 at the dinner preceding it. The chairman and speaker was Walter Samans, chief engineer of the Atlantic Refining Company, who discussed the subject of "Field Problems in the Construction of Storage Tanks and Pressure Vessels." A number of well-selected slides showing numerous types and sizes of tanks and vessels were used to illustrate his talk. The program was concluded with three reels of motion pictures showing the uses of petroleum from ancient times down to the present. These pictures, which were prepared by the U. S. Bureau of Mines, were furnished through the courtesy of the Sinclair Refining Company. Light refreshments were served after the meeting, and a social hour was enjoyed.

San Diego Section

Several business matters, including the forthcoming district meeting in Phoenix, Ariz., were discussed at the October meeting of the San Diego Section. At the conclusion of the business session, Raymond A. Hill, Director from District 11, was introduced. After discussion the attitude of the Board toward Local Section problems, Mr. Hill gave a talk on the Colorado River flood situation. In this he pointed out the fact that Boulder Dam will not remove the menace of floods and commented also on other control projects in the Southwest. An enthusiastic discussion followed. There were 20 present.

San Francisco Section

On October 8 the San Francisco Section held a special dinner meeting, at which the speaker was Dr. Charles Terzaghi of Vienna, who gave an illustrated talk on the "Settlement of Foundations on Clay." There were 175 present. The regular meeting of the Section took place on October 20. On this occasion Jeptha A. Wade, chief engineer of the California Water Service Company, spoke on recent developments in the treatment of water supplies, and Benjamin Benas, chief sanitary engineering designer for the city of San Francisco, discussed progress in the design of the San Francisco sewage-disposal plant. There were 130 present. On November 5 the Section joined the other Founder Societies in a special program devoted to talks on the recently completed San Francisco—Oakland Bay Bridge. At this time an audience of 500 heard speakers describe the various construction and operation features of the project. These speakers were Charles Andrew, bridge engineer on the project; Glenn Woodruff, engineer of design; and Ralph Tudor, senior designing engineer.

St. Louis Section

The regular monthly luncheon meeting of the St. Louis Section was held on October 19 at the Mayfair Hotel, where the 38 members present were entertained by short talks and motion pictures of naval maneuvers in honor of Navy Day. A short greeting was extended by former Mayor Henry Kiel, chairman of the Navy Day Committee. The other speakers were Lt. William Pitt Kellogg and Lt. Harry F. Thomson, both of the U. S. Naval Reserve.

Syracuse Section

The Syracuse Section held a dinner meeting at the Onondaga Hotel on October 19. On this occasion the guest speaker was Arthur G. Hayden, chief designing engineer of the Westchester County Park Commission, who gave an illustrated talk on Westchester County bridges and parks.

Tacoma Section

There were 24 members and 40 visitors present at a meeting of the Tacoma Section held in the Olympian Hotel at Olympia, Wash., on October 20. After a discussion of business matters the meeting was turned over to E. L. Warner, who was in charge of the program. The first speaker was O. R. Dinsmore, office engineer of the Washington State Highway Department, who discussed the development of the department, illustrating his talk with motion pictures. Then James A. Davis, also of the State Highway Department, gave an informative talk on the financing of the department.

Texas Section

A three-day meeting of the Texas Section, held at the Texas Hotel in Fort Worth on October 8, 9, and 10, proved one of the most successful in the history of the Section. Among the out-of-town visitors present were Harry W. Dennis, Vice-President, Zone IV; Raymond A. Hill, Director, District 11, Edwin P. Arneson, Director, District 15; and George T. Seabury, Secretary of the Society. In addition to talks on Society affairs by these officers, there were numerous speakers on the technical program. This list included the following: A. A. Lund, general manager of Armour and Company, of Fort Worth; E. W. Robinson, vice-president of the McKenzie Construction Company, of San Antonio; Julian Montgomery, state director of PWA; Julian Thomas, vice-president of the Texas Electric Service Company; F. G. Jonah, chief engineer of the Frisco Lines, St. Louis; Gibb Gilchrist, Texas State Highway Engineer; W. H. Mead, chief engineer of the Salt Flat Water Company, Luling, Tex.; and Joseph R. Pelich, architect of Fort Worth. During the business session the following officers were elected: E. W. Robinson, president, and Don Lee and W. O. Jones, vice-presidents. J. T. L. McNew will continue as secretary-treasurer for another year. A dinner dance was enjoyed the first evening, and a dinner and revue the second evening. The last day was given over to a visit to the Central Centennial Exposition at Dallas, Tex.

Student Chapter Notes

Bucknell University

A well-attended meeting of the Bucknell University Student Chapter took place on October 22. After a brief introductory speech by Frank Dunham, president of the Chapter, the Society's illustrated lecture on the Catskill water supply was shown. An enthusiastic question-and-answer period followed, several of the faculty members taking a prominent part in the discussion. At the conclusion of the meeting, refreshments and a social hour were enjoyed.

Case School of Applied Science

The first meeting of the academic year was featured by the showing of the Society's illustrated lecture on the Carquinez Bridge. The Chapter was greeted by George Sowers, contact member for the Section, who assured the Chapter of the full cooperation of the Section during the coming year. Brief talks were also given by the president of the Student Chapter, and by G. E. Barnes, head of the civil engineering department.

Duke University

The Duke University Student Chapter joined with local student branches of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers in holding a smoker to welcome the freshman engineering class. Several members of the faculty were present on this occasion. This year there are 144 students enrolled in the three engineering departments at Duke University.

Lewis Institute

On October 14 members of the Lewis Institute Student Chapter were shown the Society's slides on aerial photographic mapping. A talk was given by a member of the Chapter, and plans for a smoker were discussed. There were 16 present.

Rhode Island State College

There were 23 present at a recent meeting of the Rhode Island State College Student Chapter at which numerous business matters were discussed and committees appointed. Members of the faculty also gave short talks on the Society at this session.

Tufts College

On October 15 the Tufts College Student Chapter held its first meeting of the year, which was attended by 33. After a short business meeting and a brief greeting by H. G. Harlow, president of the Chapter, two reels of motion pictures, depicting the 1936 spring flood in the Merrimac Valley, were shown by a member of the Massachusetts Department of Public Works. Other motion pictures on tests of guard rails were also shown through the courtesy of this department.

ITEMS OF INTEREST

Engineering Events in Brief

CIVIL ENGINEERING for January

AT THE Fall Meeting of the Society, held at Pittsburgh, Pa., on October 13–16, 1936, two entire days were devoted to technical sessions, instead of one as has been customary in the past. In the course of these sessions, no less than 46 papers were presented, dealing with the subjects of flood control, economic aspects of energy generation, structural application of steel and light-weight alloys, state systems of plane coordinates, stream pollution, modern highway design and construction, and volume of traffic and financial problems involved in the planning of major highways.

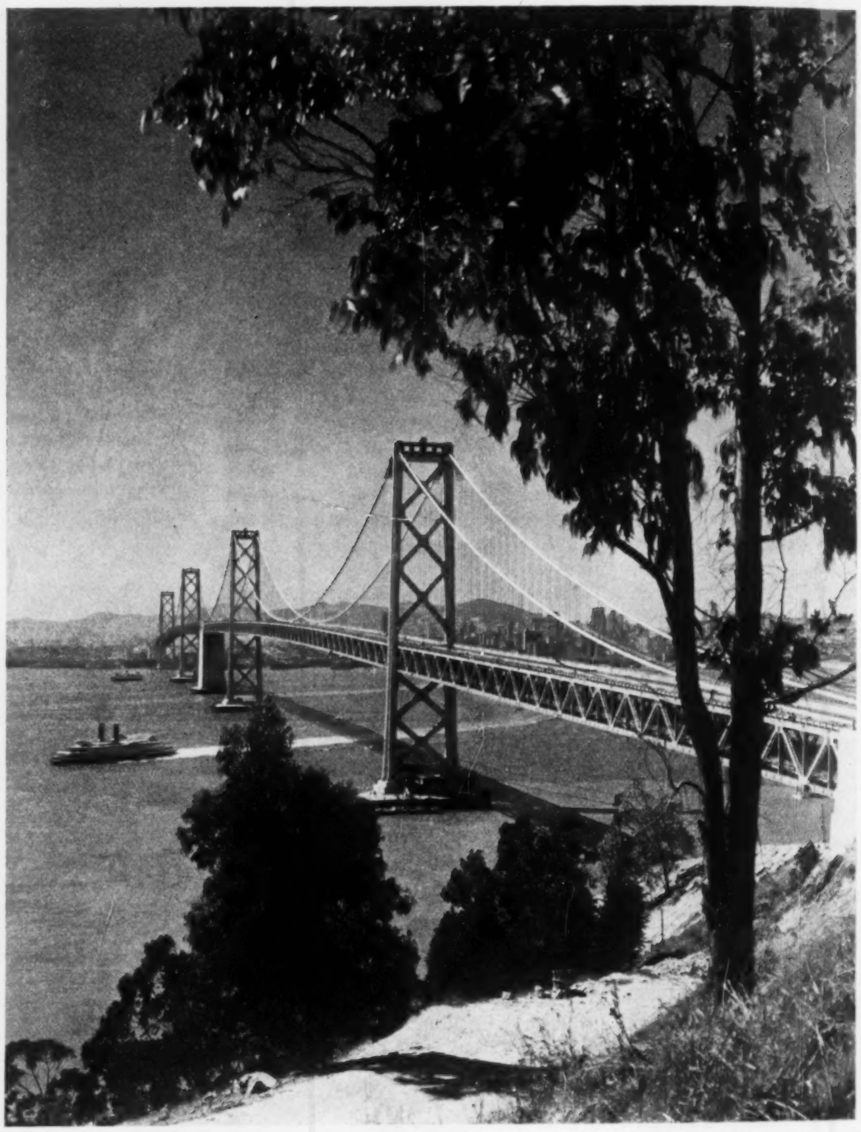
Of the entire group, those papers scheduled to be abstracted in the December issue of CIVIL ENGINEERING include two dealing with state systems of plane coordinates presented under the auspices of the Surveying and Mapping Division and the Pittsburgh Section of the Society; six arranged by the Highway Division and the Central Ohio Section to form a symposium on modern highway design and construction; and five on the subject of volume of traffic and financial problems involved in the planning of major highways arranged for by the City Planning Division and the Pittsburgh Section.

Of the remaining papers, 12 have already appeared in full in the October number of PROCEEDINGS, leaving about 20 which, it is anticipated, will be considered for possible inclusion in forthcoming issues of that publication. These will nevertheless receive brief treatment in CIVIL ENGINEERING, in order to give a more general picture of the important developments discussed at the Fall Meeting. It is possible that other papers may be added to the group scheduled for CIVIL ENGINEERING only or transferred to the list of those selected for publication in full in PROCEEDINGS at a later date. In all cases the disposition will be determined through study by the Committee on Publications.

Annual Science Exhibition to Be Held in Atlantic City

A NUMBER of displays of engineering interest will form part of the Annual Science Exhibition to be held in the Atlantic City Auditorium, December 28–31, 1936, in connection with the annual meeting of the American Association for the Advancement of Science. Among the research exhibitors will be several Nobel Prize winners, including Dr. C. G. Abbott, who will show his improved solar engine. The many organizations that are preparing exhibits and demonstrations include the Bartol Research Laboratory, the U. S. Bureau of Standards, the Rural Electrification Administration, the Smithsonian Institution, and the American Institute of Physics. The exhibitors will have the largest and most authoritative displays they have every prepared for this occasion.

The book exhibit of the Science Library will include practically all the volumes printed in 1936 on the various sciences. There will be a division devoted to books on engineering.



SAN FRANCISCO–OAKLAND BAY BRIDGE
As Seen from Yerba Buena Island Looking Toward San Francisco

San Francisco–Oakland Bay Bridge Dedicated

AN EVENT of unusual importance to the engineering world was signalized on November 12 in the official opening of the San Francisco–Oakland Bay Bridge. It marked the culmination of unique design and constructive efforts, the overcoming of many and difficult engineering problems. On page 5 is reproduced a comprehensive view of the structure. Although this does not show the completed bridge, the unusual angle of sight and the excellent photographic effects warrant its inclusion on the Page of Special Interest. A later view, of the suspension spans only, is reproduced herewith by courtesy of the U. S. Steel Company. Dreams of many engineers are fulfilled in the inception of traffic over the $8^1/_2$-mile, continuous double-deck structures which comprise this epoch-making project.

University of Minnesota Constructs Hydraulic Laboratory at St. Anthony Falls

By Lorenz G. Straub, Assoc. M. Am. Soc. C.E.
Professor of Hydraulics and Head of Hydraulics Division
University of Minnesota, Minneapolis, Minn.

A UNIQUE large-scale hydraulic laboratory is being constructed by the University of Minnesota on the Mississippi River at St. Anthony Falls. The site is on Hennepin Island—now joined to the mainland by a power dam—in the heart of Minneapolis and at the center of the city's famous milling district.

An interesting history might be related of St. Anthony Falls and the site of the laboratory, dating from the very earliest white settlements in this region. The water power rights attached to the property were utilized in early times for a sawmill; they were later acquired by the city for the operation of water turbines directly connected to a pump delivering a municipal water supply. Now that they have been secured by the University, they will serve to provide the motivating energy for its new hydraulic laboratory.

There is a head of 48 ft available at the site at all times. A long horseshoe-shaped weir constructed above the falls provides close head regulation. Facilities are being provided to handle discharges through the laboratory in excess of 300 cu ft per sec. There will be a large turbine-testing and hydraulic machinery section, as well as an unusually large river and hydraulic structures laboratory.

The building has been designed to utilize approximately half of the available head for model rivers and other experiments on flow in open channels, the level of the main experimental floor being at an elevation of 20 ft below the headwater level. The remainder of the drop encountered in passing the experimental plant permits large-scale volumetric measurement of the rate of flow. Twin basins are to be installed for measuring the flow; they will be supplied with pneumatically operated cylinder valves.

The main experimental room will be approximately 300 ft long and 45 ft wide. It will be two stories high and will contain three large channels extending the entire length of the building. One will be an overhead flume, 8 ft wide and 9 ft deep, connected directly with the headwater above the falls, and provided with numerous off-takes to supply water for the various experimental projects. The others will be low-level channels below the level of the main floor. Of these, one is to be a wasteway and the other an experimental flume arranged for a wide variety of experiments. The latter is to be 9 ft wide and 6 ft deep, and will be supplied directly from the upper pool of the river. Enough head is available to put water through the flume at the rate of about 35 ft per sec for shallow depths. A towing car will make it possible to pull current meters, model ships, and the like through the flume with the water either at rest or in motion.

The main floor of the machinery-testing laboratory will have an unobstructed space 34 ft wide and 125 ft long. It will be provided with an overhead crane. At one end of the building there will be a large turbine-testing pit extending to a depth of 25 ft below the main floor, with a tailrace at the level of the lower pool of the river. Eventually two floors will be added above the machinery laboratory to house offices, smaller research laboratories, drafting rooms, and a lecture room.

The St. Anthony Falls Hydraulic Laboratory will be used for graduate study and for many types of research projects. Experimental work is being planned in cooperation with federal, state, and commercial interests. Large-scale studies are to be made of spillways with crest grates as soon as the structure is completed, and much of the work on sediment transportation by rivers that is now being carried on at the University's existing hydraulic laboratory will be transferred to the new quarters.

The laboratory is being constructed on a horizontal limestone ledge at the extreme edge of the former falls. At present construction of the overhead flume is nearing completion and the building walls, measuring basins, and turbine pit are under construction. All rock used in the walls was quarried from the building site.

Design and general supervision of the project are under the direction of the writer. The water rights and site were contributed by the City of Minneapolis with certain easements permitted by the St. Anthony Falls Water Power Company. The project is being financed with a combination of funds contributed by the Works Progress Administration and the University of Minnesota.

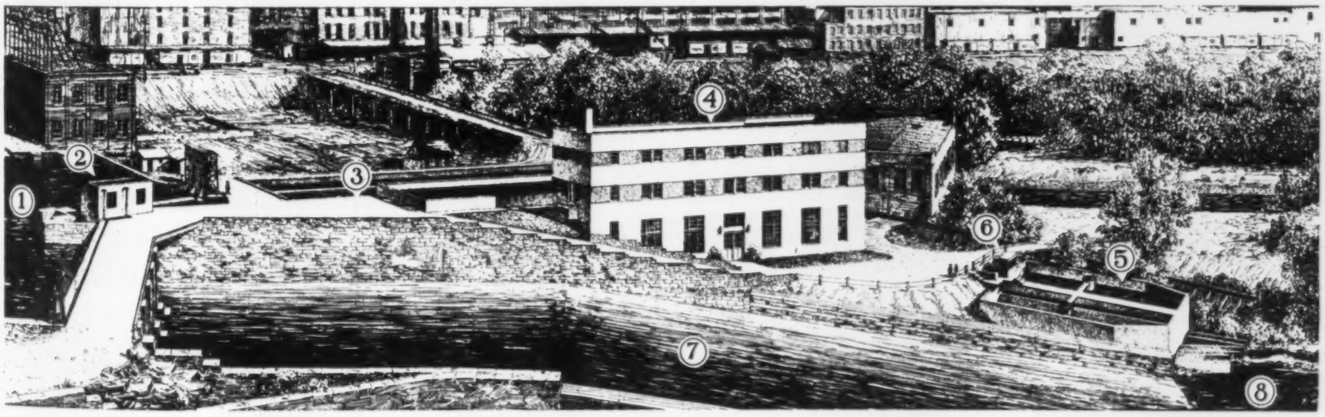
Treatment of Textile Wastes Discussed in New Booklet

The Textile Foundation, Inc., has just published a 118-page booklet on *Textile Waste Treatment and Recovery,* which is said to summarize all up-to-date information on the subject. Although technical in nature, the report is written in layman's language, and is designed to be useful both to sanitary engineers and to textile manufacturers who may cooperate with them in solving pollution problems. Data for the publication were collected during a thorough survey that included a search of domestic and foreign literature, study of unpublished research, consultation with chemists and engineers, and examination of many plants now treating textile wastes.

Among the subjects dealt with are requirements for purified effluents, textile processes and the nature of the wastes produced, and methods for treating textile wastes both separately and in combination with municipal sewage.

A number of complimentary copies are available on request to the Textile Foundation, Commerce Building, Washington, D.C.

Several members of the Society have had a prominent part in the preparation of the report. John C. Geyer is one of its co-authors; H. G. Baity was the general adviser; and T. R. Camp and H. W. Streeter were members of the advisory committee.



Perspective Rendering of St. Anthony Falls Hydraulic Laboratory, Now Under Construction

(1) Headwater Pool; (2) Laboratory Intake; (3) Roof of Main Laboratory for Open-Channel Investigations; (4) Hydraulic Machinery Laboratory and Offices; (5) Discharge Measuring Basins; (6) Control House for Measuriug Basins; (7) Wasteway of Hennepin Island Power Plant; (8) Tailwater Pool. The Existing Power Canal Is Parallel to the Laboratory and Just Behind It. and the Power House Is Immediately to the Right

Centenary of the Steam Shovel

This item is abstracted, by permission, from "Digging by 'Stame,'" a series of four articles by William Elliston Farrell in the April 1936 and succeeding issues of the "Excavating Engineer."

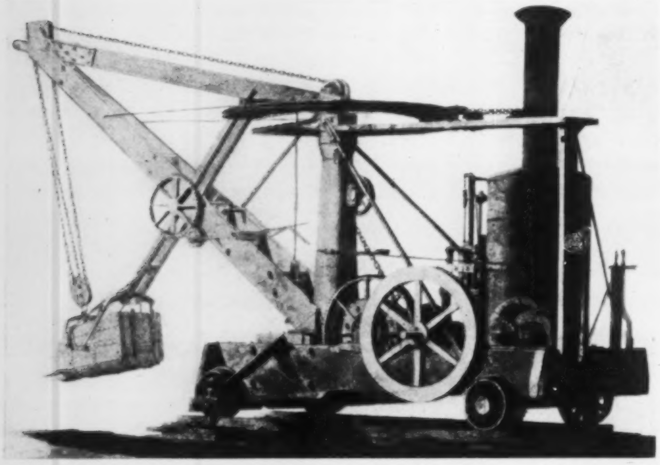
ONE HUNDRED and one years ago William Smith Otis, a 22-year-old contractor, conceived the idea of an excavator powered by steam. A year later, on June 15, 1836, he made his first application for a patent. The machine was a success, and the modern shovel differs but little from it in principle of operation, although the motive power has been changed.

There was no satisfactory power excavator before Otis's invention; practically all excavation was by pick, shovel, and wheelbarrow. Yet it was at least 20 years before more than two shovels were in use in the United States, and none were made abroad until 1876. These circumstances may be partly accounted for by the death of the inventor in 1839, and partly by the desire of the contractors owning the two shovels to possess an advantage over their competitors.

In 1835, Otis built the forerunner of the steam shovel—the first "crane excavator"—with the assistance of Charles Howe French. It followed the lines of a quarry derrick, having a mast supported by cables attached to the top and anchored to deadmen. The mast was provided with a boom, to which was hinged the end of the dipper handle, making it necessary to raise and lower the boom for each dipper load. This movement was effected by a hoisting engine, but the boom was swung sideways by man power. The machine was moved ahead in the same manner as a quarry derrick, and was unwieldy and somewhat unsatisfactory. Shortly afterward the inventors remedied many of the defects by moving the derrick and boom back on to the frame. This shovel was probably used in the construction of the Norwich and Worcester Railroad, in Massachusetts.

Otis returned to Philadelphia in 1836 and attempted through his own efforts to have various parts of the improved shovel as he conceived it built in several shops. When on the verge of failure, he became acquainted with the firm of Garret and Eastwick, to whom he gave an order to build a complete machine. Their foreman, Joseph Harrison, Jr., was a man of unusual skill and ability, and the perfection of many of the mechanical details probably owed much to him. Harrison soon bought out Garret's interest, and by 1843 the firm had manufactured seven shovels. One of them was sent to England, and four to Russia. The Troy *Daily Whig* described these machines as varying in power from 8 to 16 "horses," and capable of doing the work of 50 or 60 men.

Like most other labor-saving inventions, the shovel was both welcomed and opposed. The American Institute of the City of New York, in awarding it its highest premium, said: "The masses of unruly men collected on our public works will be dispersed by its use, and compelled to till the land, thereby making them good and quiet citizens, and putting an end of the disturbances, quarreling and complaints incident to such collections of men." On the other hand, it is reported that on the Welland Canal, sometime between 1840 and 1850, the machinery of an Otis steam excavator was installed on a dredge, and that the dredge lay idle for a year "on account of threats from the Irish laborers whose mouths it would rob." Eventually, however, the dredge was put to work.



THE EARLIEST ILLUSTRATION OF THE OTIS MACHINE AS BUILT BY EASTWICK AND HARRISON
Drawn in 1841 by S. Rufus Mason

In England similar reactions were encountered. The shovel that had been sent there was in use as early as 1842 on the Eastern Counties Railway. A local journal described it in laudatory terms, and succeeded in stirring up comment from readers who had somewhat different opinions. One wrote:

"Sir—

"I see in the Railway Journals an account of an extraordinary excavating machine—a real 'Giant'— . . . doing such superhuman wonders that half of the race of 'navvies' may thenceforth consider their occupation gone." He went on to criticize the production figures claimed by the owners, and concluded: "So huge, clumsy, and multitudinous a combination of beams, shafts, posts, cylinders, pistons, levers, chains, wheels, pullies, etc., to accomplish a very small affair, I never before beheld. One cannot fancy a more instructive instance of the vanity of attempting to do by machinery what machinery is incapable of doing. . . . It is but a spade after all, . . . that can earn for its giant owner no more than is necessary for decent maintenance.

I am Sir,
Your Constant Reader,
PROBE."

"Probe" was really voicing the opposition of a tremendous army of pick-and-shovel men known in England as "navigators" or "navvies," who wandered about from one public work to another, apparently belonging to no country and having no home.

It has been mentioned that four of the first shovels went to Russia. This came about through the recommendation of a certain Chevalier de Gerstner, who was sent to the United States in 1839 to investigate our methods of railroad construction. He reported that one of the causes of cheap construction was the use of labor-saving machinery, and on his recommendation Maj. George W. Whistler, then chief engineer of the Western Railroad, where the shovels were being used, was selected as consulting engineer for the Petersburg and Moscow Railway in Russia. Many other orders for machinery and machine tools for Russia, in addition to the orders for the four shovels, were placed in Philadelphia at that time, to such an extent that one writer of the time commented: "But for the Russian orders many of our industrious mechanics would now be out of work."

The eventual commercialization of the steam shovel was due to O. S. Chapman, a successful railroad contractor who married the widow of Otis in 1845. Sometime during the 1850's he began to have the shovels made by the Globe Iron Works, later the John Souther Company, of Boston, using the original Otis construction. Strange to relate, although the Chapman-Otis shovels continued to be built until 1912 or 1913, there were no radical changes in their design.

Wise and Otherwise

Three persons, A, B, and C, sat together in a room without mirrors or other reflecting surfaces but where each had a full view of the others. Professor Abercrombie entered and touched each successively upon

ANNUAL MEETING of the Society, to be held in New York, N.Y., January 20–23, 1937

the forehead with his finger. He then made the following remarks:

"Gentlemen: I have observed that you are all men of intelligence and possessed of deductive powers. Now I wish to test which thinks the quickest. I may or may not have left a smudge on your foreheads. None of you is to communicate in any way with another, but each is to sit still in his present position. If any one of you sees a mark on the forehead of any other, he is to whistle. If and when any one of you decides that he himself is marked, he is to stop whistling."

A, B, and C immediately began to whistle, for all three foreheads had been smudged. The whistling continued for a considerable time, until finally A stopped. After hearing A's statement of the reasoning involved, the Professor proclaimed him the winner of the test. What was A's successful explanation?

November's problem dealt with two prospective witnesses in a pending trial, of whom (by reputation) one spoke the truth 3 out of 4 times, the other 3 out of 5. Stripped of inessentials, the question resolves itself into "What are the chances that the witnesses will agree in answering 'yes' or 'no' to a given question?"

The chances that the witnesses will agree on the truth are evidently $^3/_4 \times {}^3/_5 = {}^9/_{20}$, while the chances that they will agree untruthfully are $^1/_4 \times {}^2/_5 = {}^2/_{20}$. The chances for agreement are therefore $^9/_{20} + {}^2/_{20} = {}^{11}/_{20}$. In other words the odds are 11 to 9 in favor of agreement, although 9 to 11 against agreement on the truth.

Suggestions for other problems for Professor Abercrombie's column, accompanied by solutions, may be addressed to the editor. Solutions should preferably be sent in separate enclosed envelopes.

Brief Notes from Here and There

Announcement is made of the founding of a new professional group, the Venezuelan Association of Engineers. Its aims include the unification of the profession in Venezuela; protection of the interests of its members; the cultural, technical, economic, and social development of members; and the study of local technical problems. Qualified engineers, foreign as well as Venezuelan, are eligible for membership. The organization plans to issue its own periodical.

* * * *

It has been announced that the Fifth International Congress for Applied Mechanics will meet on September 12–16, 1938, in Cambridge, Mass., at Harvard University and at the Massachusetts Institute of Technology. The program will cover three main divisions of applied mechanics: (1) structures, elasticity, plasticity, fatigue, strength theory, crystal structure; (2) hydrodynamics, aerodynamics, gasdynamics, hydraulics, meteorology, water waves, heat transfer; and (3) dynamics of solids, vibration and sound, friction and lubrication, wear and seizure. Dormitory facilities will be available at Harvard University. Following the Congress proper, it is expected that visits will be made to the National Bureau of Standards in Washington, D.C., and to Langley Field at Hampton, Va. Inquiries should be addressed to the Congress, Massachusetts Institute of Technology, Cambridge. Mass.

NEWS OF ENGINEERS

Personal Items About Society Members

Arthur S. Tuttle, in addition to his duties as New York state engineer for PWA, has been appointed PWA project engineer for the new $58,000,000 Queens-Midtown Tunnel, New York City.

C. E. Myers, consulting engineer of Philadelphia, Pa., was recently elected president of the Pennsylvania State Registration Board for Professional Engineers.

Joseph Goodman has been appointed commissioner of the Department of Water Supply, Gas, and Electricity of New York City, which has charge of all structures for the supply and distribution of water; of investigations for and construction of all necessary extensions to the distribution system; of regulating the use of water and fixing the charges; of furnishing the city with gas, electricity, and steam; and similar responsibilities. Mr. Goodman began work in the department thirty-five years ago, and prior to his appointment as commissioner served as deputy chief engineer.

Joseph Goodman

Charles M. Allen, professor of hydraulic engineering at Worcester Polytechnic Institute, has been awarded the Worcester Reed Warner Medal of the American Society of Mechanical Engineers, which is given annually to the author of the best paper on progressive ideas in mechanical engineering or efficiency in management. This medal will be presented at the 1936 annual meeting of that society.

William Bowie was awarded the degree of doctor of laws by the University of Edinburgh on September 17. Major Bowie is chief of the division of geodesy of the U. S. Coast and Geodetic Survey.

Chia Y. Hou, formerly associate managing director and associate engineer-in-chief of the Chekiang-Kiangsi Railway, Hangchow, China, is now director and chief engineer of the Hunan-Kweichow Railroad. His headquarters are at Siangtan, Hunan, China.

Haywood R. Faison has been transferred from the Gulf Division Office of the U. S. War Department at New Orleans, La., to duty with the Board of Engineers for Rivers and Harbors at Washington, D.C., with the grade of senior engineer.

H. C. Neuffer has resigned as district supervising engineer for the U. S. Indian Irrigation Service at Albuquerque, N. Mex., to enter partnership with **W. R. Holway**, consulting engineer of Tulsa, Okla. Mr. Neuffer will represent the firm in Albuquerque.

Paul C. Grueter, previously technical assistant on Cape Cod Canal research for the U. S. Engineer Department at the Massachusetts Institute of Technology, is now a junior engineer. His headquarters are at the Custom House in Boston, Mass.

Don S. Hays was recently appointed twenty-second principal assistant on the National Resources Committee, District No. 11, comprising the Pacific Northwest, under **Samuel B. Morris**, consultant, at Stanford University.

Samuel M. Rudder, formerly engineer of surveys and plans for the Missouri State Highway Department, has been appointed assistant chief engineer of the department.

David J. Peery is now an instructor in civil engineering at the Missouri School of Mines. Previously he was in the Missouri State Highway Department as bridge inspector on the Missouri River bridge near St. Charles, Mo.

John C. Guibert was recently appointed county engineer of Nassau County, New York. Formerly he was an assistant engineer in the engineering department of that county.

Stanley H. Wright, consulting engineer of Chapel Hill, N.C., was recently appointed acting state director of public works of North Carolina.

Ralph C. Chaney, previously resident engineer inspector of the PWA nonfederal service in the Cleveland area, has been appointed state engineer inspector of PWA for Ohio.

S. C. Jemian, an associate engineer in the U. S. Engineer Office, has been transferred from the Passamaquoddy Project at Eastport, Me., to Washington, D.C., where he is engaged in hydrologic studies and investigations.

Wallace W. Sanders, who has been connected with the Kentucky State Highway Department for the past twelve years in a variety of engineering capacities, was recently appointed district engineer of the third district of the department. His headquarters are in Louisville.

Gordon W. Harvey has resigned as park engineer with the New York State Department of Public Works to accept an appointment as assistant engineer with New York World's Fair, 1939, Inc., Empire State Building, New York City, N.Y.

Carl E. Green is spending the present year on a fellowship in graduate study at Stanford University, where he is specializing in sanitary engineering and public health. The fellowship, which was awarded by the Oregon State Board of Health, was made possible by funds from the U. S. Public Health Service.

Paul D. Miller, who has been assistant division engineer of the Toledo division of the Pennsylvania Railroad, Toledo, Ohio, is now chief draftsman for that railroad.

William P. Day, engineer and architect of San Francisco, Calif., has been elected vice-president of the Golden Gate International Exposition in charge of construction for the world's fair to be held in San Francisco in 1939.

Fred A. Salmon, Sr., is now with the Simplicity System Company, of Chattanooga, Tenn. He was formerly assistant engineer for the Alabama State Highway Department.

James W. Gambrell has resigned as engineering aide in the Soil Conservation Service to become junior hydraulic engineer in the Water Resources Branch of the U. S. Geological Survey. He is located in Asheville, N.C.

Han Ying Chang, previously chief secretary of the Yellow River Commission at Honan, China, is now vice-director of the Bureau of Hydraulic Engineering of the National Economic Council, at Nanking, China.

H. Alden Foster, for the past two years resident engineer for Parsons, Klapp, Brinckerhoff and Douglas on the Sutherland project of the Platte Valley Public Power and Irrigation District, has joined the engineering staff of the New York World's Fair Corporation.

F. W. Stubbs, Jr., previously assistant professor of civil engineering at the University of Illinois, has become professor of civil engineering and head of the civil engineering department at Rhode Island State College.

Henry C. Peirson, formerly district engineer for the Eastern Clay Products Association, of Philadelphia, Pa., is now promotion engineer for Gladding, McBean, and Company, manufacturers of clay products, of Seattle, Wash.

DECEASED

Edward Everett Buchanan (M. '89) of Elmira, N.Y., died on October 29, 1936. Mr. Buchanan was born in Utica, N.Y., on August 11, 1859. From 1885 to 1889 he was with the Union Bridge Company, at Athens, Pa. For the next two years he was chief engineer, secretary, and part owner of the Elmira Bridge Company, which was taken over by the American Bridge Company in 1900. From the latter year until his retirement from active engineering work in 1902, he was chief engineer and manager of the Elmira plant of the American Bridge Company. Mr. Buchanan was the author of *Tables of Squares*, the first book of its kind, now in its thirteenth edition.

Edward Wesley Bullard (Assoc. M. '24) construction engineer for the Texas Company, Chicago, Ill., died on June 5, 1936. Mr. Bullard was born in Mechanicsburg, Ill., on June 26, 1889, and graduated from the University of Illinois in 1913. During the war he served successively as first lieutenant and captain in the Corps of Engineers, A.E.F. From 1919 to 1922 he was construction engineer for Frank D. Chase, Inc., and from 1922 to 1924 was building inspector for the Illinois Central Railroad. He was engineer and superintendent for Avery Brundage, general contractor, from 1925 to 1927, becoming construction engineer for the Texas Company in the latter year.

The Society welcomes additional biographical material to supplement these brief notes and to be available for use in the official memoirs for "Transactions."

Charles Willis Chassaing (Assoc. M. '10) structural engineer for the Selden-Breck Construction Company, of St. Louis, Mo., died June 1, 1934. Mr. Chassaing was born in Gratiot, Wis., in 1872, and graduated from Washington University in 1896. From 1899 to 1907 he was in the employ of the Union Iron and Foundry Company, of St. Louis, Mo., where he was chief draftsman. He was later engineer for Eames and Young, and engineer and superintendent of construction for E. J. Eckel and Company, architectural firms of St. Louis, and finally entered the employ of the Selden-Breck Construction Company. Mr. Chassaing was with the latter organization for many years.

Charles Homer Clark (M. '18) died at his home at Library, Pa., on May 25, 1936, at the age of 62. Mr. Clark was born in Columbus, Ohio, and educated at Ohio Normal University. From his graduation in 1894 until 1897 he was a draftsman for the Forest City Steel and Iron Company, and from 1900 to 1903 was employed on structural steel design by the Jones and Laughlin Steel Company. Later he was chief engineer of the Tennessee Coal, Iron and Railroad Company. In April 1908 he became president of the Clark Car Company, Pittsburgh, Pa., engaged in the design and construction of special railway freight equipment. Mr. Clark continued in this work until his retirement in 1930.

Nicholas Snowden Hill, Jr. (M. '16) consulting engineer of New York City and president of the Hackensack (N.J.) Water Company, died at Green Farms, Conn., on October 18, 1936. He was 67. Mr. Hill was a native of Baltimore County, Maryland, and a graduate of Stevens Institute of Technology. He was chief engineer of the Baltimore Water Department from 1896 to 1897 and of the New York City Water Department from 1902 to 1903. In 1901 he established a consulting practice in New York. Among other projects, he designed and constructed Pocantico Dam, laid out the water systems of Albany, N.Y., and Tampa, Fla., and made a study of the water works of Shanghai, China (1931). He became president of the Hackensack Water Company in 1926.

Albert Frederick Johntz (M. '33) engineer for the North-Eastern Construction Company, Winston-Salem, N.C., died in that city on October 17, 1936, at the age of 49. He was born at Abilene, Kans., and graduated from the University of Kansas in 1910. His early work included engagements with the El Paso and Southwestern Railway, the Kansas City Terminal Railway, and the Chicago, Milwaukee and St. Paul Railway. From 1915 to 1918 he was in the office of the chief engineer of the Cuba Railroad, and from 1918 to 1925 he was a civil engineer in the construction division of the U. S. Army. In 1925 he became chief engineer for the North-Eastern Construction Company, in charge of estimating, construction, and design.

Charles Patterson McCausland (M. '13) engineer of surveys for the Western Maryland Railway, died on November 4, 1936. Mr. McCausland was born at Lonaconing, Md., on August 27, 1881. His early experience included work for the New York Central Railroad and a partnership in the Lorain Engineering Company. In 1910 Mr. McCausland became bridge engineer for the Western Maryland Railway. In 1912 he was promoted to the position of locating engineer, and in 1918 was made engineer of surveys.

Frank Howard Neff (M. '25) for almost fifty years a member of the faculty of the Case School of Applied Science, died at his home in South Euclid, Ohio, on October 19, 1936. He was 71. Professor Neff was born in Cleveland, Ohio, and educated at the Case School of Applied Science and the Ecole des Ponts et Chausées and the Sorbonne in Paris. In 1887 he became an instructor in mathematics and civil engineering at the Case

School. In 1893 he was made assistant professor of civil engineering, and from 1897 until his retirement in 1931 he was professsor in charge of the civil engineering department.

Leo Thomas Peden (M. '19) of Houston, Tex., died on December 11, 1935. He was born at Fayette, Miss., on July 29, 1884, and graduated from the Agricultural and Mechanical College of Texas in 1904. Mr. Peden's early experience was gained in railroad surveys, and from 1914 to 1917 he was draftsman, assistant engineer, and designer in the engineering department of the city of Houston. From 1918 to 1922 he was general superintendent of the Gulf Bitulithic Company, and from the latter year to 1930 was district manager for Smith Brothers, Inc., general contractors of Houston. From 1931 to 1933 he was connected with the Asphalt Engineering Company of Houston.

Marshall Hudson Reese (Jun. '29) lieutenant (junior grade), U. S. Coast and Geodetic Survey, Washington, D.C., was drowned on September 26, 1936, while on surveying duty in the Aleutian Islands, Alaska. Born in Arcadia, La., on October 5, 1904, he graduated from Louisiana State University in 1928, and entered the employ of the U. S. Coast and Geodetic Survey as deck officer. In 1935 he was made lieutenant.

William Ernest Smith (M. '13) superintendent of Minnesota Contractors, Inc., St. Paul, Minn., died on August 6, 1936. Mr. Smith was born in Ray County, Missouri, on February 20, 1881, and graduated from the University of Missouri in 1903. From 1904 to 1913 he maintained a contracting business, and from the latter year until 1921 was superintendent of construction in the St. Paul Department of Public Works. He then became general superintendent for Fielding and Shepley, Inc., of St. Paul, where he remained until 1935.

Changes in Membership Grades

Additions, Transfers, Reinstatements, and Resignations

From October 10 to November 9, 1936, Inclusive

Additions to Membership

Akans, James Ernest (Jun. '36), Senior Eng. Aide, Party Chf. and Concrete Insp., U. S. War Dept., Chattanooga, Tenn.

Albrecht, Richard William (Jun. '36), 1753 East 7th St., Brooklyn, N.Y.

Arnold, Richard Roberts (Jun. '36), Lieut., Corps of Engrs., U. S. A., Fort Belvoir, Va.

Baillie, David Gemmell, Jr. (Assoc. M. '36), Asst. Engr., New York City Tunnel Authority, New York (Res., 1528 Union St., Brooklyn), N.Y.

Bartley, John Coleman (Jun. '36), 2721 Calhoun St., New Orleans, La.

Boggs, Allen Claude (M. '36), Const. Supt. and Civ. Engr., Standard Oil Co., 1352 East South St., South Bend, Ind.

Bow, Wilson Francis (Jun. '36), Bowmont, Idaho.

Brendel, Robert Oliver (Jun. '36), 900 St. Clair Ave., East St. Louis, Ill.

Brooks, George Everett (Jun. '36), 544 Pleasant St., Worcester, Mass.

Burack, William Durwood (Jun. '36), Engr., Wallace & Tiernan, 90 Sycamore Ave., Livingston, N.J.

Carter, Marshall Sylvester (Jun., '36), Lieut., U. S. A., West Point, N.Y.

Christman, William Rawle (Jun. '36), 791 Jason Ave., Akron, Ohio.

Coffey, Philip John (Jun. '36), Care, U. S. Public Health Service, 816 New Post Office Bldg., Chicago, Ill.

Coopey, Martin Portman (Jun. '36), Route 2, Corvallis, Ore.

Cross, Oscar Reeves, Jr. (Jun. '36), 1598 Capistrano Ave., Berkeley, Calif.

Cutts, Charles Eugene (Jun. '36), 291 Macalester Ave., St. Paul, Minn.

Dallas, John, Jr. (Jun. '36), Instr., Dept. of Architecture, Pennsylvania State Coll. (Res., University Club), State College, Pa.

Davis, John Williams (Jun. '36), 15 Bigelow Ave., Mill Valley, Calif.

Degenkolb, Henry John (Jun. '36), 2520 Channing Way, Berkeley, Calif.

de Lancey, Raymond Winthrop (Jun. '36), Insp., State Highway Comm., Box 2, Woodburn, Ore.

Dobrochowski, Vincent Joseph (Jun. '36), 21 Walbar St., Rochester, N.Y.

Downing, Claire Ansel (Assoc. M. '36), Engr. in Chg., Municipal Testing Laboratory, City of St. Louis, 55 Municipal Courts Bldg. (Res., 5372 Cabanne Ave.), St. Louis, Mo.

Dugan, Albert Francis (Jun. '36), 8002 Jeanette St., New Orleans, La.

Dully, Howard Franklin (Jun. '36), 0152 South West Palatine Rd., Portland, Ore.

Ettinger, Richard Eugene (Jun. '36), Onondaga St., Skaneateles, N.Y.

Fleet, Gerald Allen (Jun. '36), 2188 Creston Ave., New York, N.Y.

Fletcher, Robert Joseph (Jun. '36), 136-20 Sixty-first Rd., Flushing, N.Y.

Foehl, Paul Joseph (Jun. '36), 680 South Corona St., Denver, Colo.

Frazier, Francis Virgil (Jun. '36), 818 South Harvard, Los Angeles, Calif.

Giddings, William Arthur (Jun. '36), Chainman, Bureau of Reclamation, Antioch (Res., 1619 Berkeley Way, Berkeley), Calif.

TOTAL MEMBERSHIP AS OF NOVEMBER 9, 1936

Members	5,637
Associate Members	5,978
Corporate Members	11,615
Honorary Members	24
Juniors	3,161
Affiliates	89
Fellows	1
Total	14,890

Gill, Irving Leo (M. '36), Signal Engr.-Chf., Signal Div., Bureau of Lighthouses, U. S. Govt. (Res., 5427 Thirty-ninth St., N. W.), Washington, D.C.

Glanding, James Henry (Assoc. M. '36), Engr. and Estimator, Tilghman Moyer Co., Allentown (Res., 6032 Wissahickon Ave., Philadelphia), Pa.

Goettl, John Philip (Jun. '36), 124 Tenth Ave., South, South St. Paul, Minn.

Grant, John William (Assoc. M. '36), Chf. Engr. of Design and Constr., Atlas Mineral Products Co., Mertztown (Res., 149 East Main St., Kutztown), Pa.

Haber, Richard Adam (Jun. '36), Laboratory Asst., State Highway Dept., Dover (Res., 205 East 23d St., Wilmington), Del.

Hall, William Graham (Jun. '36), 19 McKinley Ave., Middletown, Ohio.

Harden, Milton Jones (Assoc. M. '36), With U. S. Geological Survey, 410 Federal Bldg., Chattanooga, Tenn.

Harris, Ernest Richard, Jr. (Jun. '36), 2325 Birch St., Denver, Colo.

Hasell, Philip Gadsden (Assoc. M. '36), Asst. State Director of Malaria Control, U. S. Public Health Service, 216 U. S. Court House, Columbia, S.C.

Heidenreich, Robert Monroe (Jun. '36), 1250 Tenth Ave., San Francisco, Calif.

Jennings, Roy Turney (Jun. '36), 4622 Chambliss Ave., Knoxville, Tenn.

Jennison, James Henry (Jun. '36), 1131 North Wilson Ave., Pasadena, Calif.

Johnson, William Martin (Assoc. M. '36), Engr., Wiley & Wilson, 309 Warwick Lane, Lynchburg, Va.

Johnston, James Wilbur (Jun. '36), Care, TVA, Guntersville Dam, New Hope, Ala.

Jones, Howard Richard (Assoc. M. '36), Associate Civ. Engr., U. S. Forest Service (Res., 201 Oglethorpe St., N.W.), Washington, D.C.

Kalmbach, Olin (Jun. '36), Asst. to R. J. Tipton (Res., 2654 Forest St.), Denver, Colo.

Keenan, Howard Underhill (Jun. '36), Balboa Heights, Canal Zone.

Kempe, Frank Arthur, Jr. (Jun. '36), Junior Draftsman, State Highway Dept. (Res., 656 Portland Ave.), St. Paul, Minn.

Kunzer, Paul Joseph (Jun. '36), 5336 Cornell Ave., Chicago, Ill.

Leadabrand, Joseph Albright (Jun. '36), 1255 Bryn Mawr Ave., Chicago, Ill.

LeFeber, Charles LeRoy (Jun. '36), 313 North 15th St., Albuquerque, N.Mex.

Lessard, Francis Henry (Jun. '36), 17 Wyman St., Brockton, Mass.

Lewis, Walter Smith (Jun. '36), 260 Seaman Ave., New York, N.Y.

Lucas, Frank Earl (Jun. '36), 342 South 10th St., Corvallis, Ore.

Lyon, Henry Louis (Assoc. M. '36), Res. Engr. and Inspecting Engr., U. S. Bureau of Public Roads, Dist. 2, Room 426, Federal Office Bldg., San Francisco, Calif.

McCluskey, William Oliver, III (Jun. '36), 37 Walnut Ave., Wheeling, W.Va.

McDonald, Murray (Jun. '36), 1911 Thirty-seventh Ave., West, Vancouver, B.C., Canada.

McFadden, John Joseph, Jr. (Jun. '36), Field Engr., Board of Transportation, New York, N.Y. (Res., 250 Summit Ave., Bogota, N.J.).

Martin, George Blair (Jun. '36), 3100 Beechwood Boulevard, Pittsburgh, Pa.

Miller, Fabian Sebastian (Assoc. M. '36), Asst. City Engr. (Res., 734 Waverley St.), Palo Alto, Calif.

Miller, Ward B. (Jun. '36), 404 South Franklin St., Garrett, Ind.

Morea, Thomas Anthony (Jun. '36), Senior Draftsman and Asst. Engr. of Constr., Park Dept. of Queens (Res., 23-06 Twenty-first St.), Astoria, N.Y.

Morris, Irvin Daniel (Jun. '36), Kettle Falls, Wash.

Newman, Walter Charles, Jr. (Jun. '36), 28 Newman Ave., Johnston, R.I.

Nolan, Charles Groetzinger (Jun. '36), Portland, Pa.

Northrup, Milton George (Jun. '36), 839 West 43d Pl., Los Angeles, Calif.

Oak, Emmet Joseph (Jun. '36), 2695 Briggs Ave., New York, N.Y.

O'Loughlin, Thomas John (Jun. '36), With State Highway Dept., 1214 Second St., S.E., Rochester, Minn.

Ottinger, Fred John (Jun. '36), 278 Fulton Ave., Jersey City, N.J.

Paller, Jack (Jun. '36), 661½ La Veta Terrace, Los Angeles, Calif.

Patterson, Charles Bird (Jun. '36), 1337 Chambers St., Vicksburg, Miss.

Prime, Ellis Roy (Jun. '36), Fort McKinley, Portland, Me.

Robins, Thomas Matthews (M. '36), Col. Corps of Engrs., U. S. A., Div. Engr., North Pacific Div. (Res., 2675 South West Vista Ave.), Portland, Ore.

Roelke, Paul Lewis (Jun. '36), Teegarden, Ind.

Romig, William Davis (Jun. '36), With Bureau of Reclamation, Denver (Res., 966 Fifteenth St., Boulder), Colo.

Salvato, Joseph Christopher Anthony, Jr. (Jun. '36), 6858 Seventy-sixth St., Middle Village, N.Y.

Schmidt, Frank John (Jun. '36), 426 Menahan St., Ridgewood, N.Y.

Siess, Chester Paul (Jun. '36), Party Chf., State Highway Comm.; 1906 Monroe St., Alexandria, La.

Silber, Victor Arthur (Jun. '36), 4131 Magnolia Ave., St. Louis, Mo.

Smith, Earl LeRoy (Jun. '36), Box 2298, Boise, Idaho.

Smith, Franklin Folk (Jun. '36), Center Ave., Topton, Pa.

Smith, Ralph Albert (Assoc. M. '36), Res. Engr., Consoer, Townsend & Quinlan (Res., 874 Second St.), Muskegon, Mich.

Sommer, William Nelson (Jun. '36), Junior Highway Engr., State Div. of Highways (Res., 219 South Lewis St.), Springfield, Ill.

Steiner, Richard Lewis (Jun. '36), 1512 Bolton St., Baltimore, Md.

Stompler, Vernon Floreing (Jun. '36), Langhorne, Pa.

Stoyke, Ludwig Theodore (Jun. '36), Dept. of Theoretical and Applied Mechanics, Coll. of Eng., Univ. of Illinois, Urbana, Ill.

Sullivan, Arthur Bushnell (Jun. '36), 1340 Thirty-seventh St., Sacramento, Calif.

Tice, Richard Howell (Jun. '36), 49 Mt. Pleasant Ave., West Orange, N.J.

Tinney, Edward Llewellyn (Jun. '36), Junior Eng. Aide, State Dept. of Public Works, Div. of Highways, Dist. III, Marysville (Res., 754 Bridge St., Yuba City), Calif.

Uttal, Sheldon (Jun. '36), 240 West 98th St., New York, N.Y.

Van Driest, Edward Reginald (Jun. '36), Iowa Inst. of Hydr. Research, Univ. of Iowa (Res., 605 Melrose Ave.), Iowa City, Iowa.

Van Löben Sels, Maurits Just (Jun. '36), Vorden, Calif.

Vessell, Frank George (Jun. '36), 413 Ontario St., S.E., Minneapolis, Minn.

Volland, Richard Edward (Jun. '36), Steel Designer and Engr., Rosslyn Steel & Cement Co. (Res., 1515 Hamlin St., N.E.), Washington, D.C.

Wanke, Irvin Robert (Jun. '36), 340 Twelfth St., Sparks, Nev.

Wilby, Francis Bowditch (M. '36), Col., Corps of Engrs., U. S. A., Div. Engr., Gulf of Mexico Div. (Res., 7433 St. Charles Ave.), New Orleans, La.

Wright, Samuel Robert (Assoc. M. '36), Utility Engr., City of Fort Worth, City Hall, Fort Worth, Tex.

Wrocklage, John Francis (Jun. '36), 507 West 175th St., New York, N.Y.

MEMBERSHIP TRANSFERS

Adams, Francis Lee (Jun. '29; Assoc. M. '36), Hydr. Engr., Federal Power Comm., 800 Central Savings Bank Bldg., Denver, Colo.

Ash, Arlington Darwin (Jun. '30; Assoc. M. '36), Asst. Engr., U. S. Geological Survey, Room 3004, Dept. of Interior, Washington, D.C.

Bunnell, Arthur Valentine (Jun. '28; Assoc. M. '36), Designer and Detailer, N. Y. C. R.R., 466 Lexington Ave., New York, N.Y. (Res., 15 Stanley Oval, Westfield, N.J.).

Burgess, George Van Trump (Jun. '27; Assoc. M. '36), Gen. Mgr., Eastern Service Studios, Inc., 35-11 Thirty-fifth Ave., Astoria (Res., 81 Alta Vista Drive, Tuckahoe), N.Y.

Dow, Alex (M. '06; Hon. M. '36), Pres., The Detroit Edison Co., 2000 Second Ave., Detroit, Mich.

Dow, Melvin Charles (Jun. '26; Assoc. M. '36), Asst. Engr., New York Trap Rock Corporation, 252 Water St., Newburgh, N.Y.

Duggan, George Herrick (M. '95; Hon. M. '36), Chairman of the Board, Dominion Bridge Co., Ltd., and Dominion Eng. Works, Montreal, Quebec, Canada.

Faigle, John Emil (Jun. '31; Assoc. M. '36), Lieut. (j. g.) C.E.C., U.S.N. Asst. to Public Works Officer, Norfolk Navy Yard, Portsmouth, Va.

Harvey, Gordon White (Jun. '25; Assoc. M. '36), Asst. Engr., New York World's Fair, 1939, Inc., Empire State Bldg., New York (Res., 8437 Dana Court, West Forest Hills), N.Y.

Hawthorn, George Edward (Assoc. M. '25; M. '36), Asst. Prof., Civ. Eng., Univ. of Washington (Res., 4205 Francis Ave.), Seattle, Wash.

Hoffmann, Robert (Assoc. M. '01; M. '04; Hon. M. '36), Cons. Engr., Public Works, City of Cleveland, 518 City Hall (Res., 1871 East 87th St.), Cleveland, Ohio.

Kaupke, Charles Lewis (Assoc. M. '25; M. '36), Water Master, Kings River Water Assoc., 402 Pacific Southwest Bldg., Fresno, Calif.

Landon, Ransom Durell (Jun. '31; Assoc. M. '36), Associate Prof., School of Eng., Southern Methodist Univ. (Res., 3609 Granada St.), Dallas, Tex.

Leak, Howard Swink (Jun. '27; Assoc. M. '36), Asst. Engr., U. S. Geological Survey, Box 1311 (Res., 2215 East 4th St.), Tucson, Ariz.

Lippincott, Joseph Barlow (M. '99; Hon. M. '36), Cons. Hydr. Engr., 543 Petroleum Securities Bldg., Los Angeles, Calif.

Mulholland, Jack (Jun. '31; Assoc. M. '36), Cons. Engr., 2d Floor, Union Bank Chambers, Queen St., Brisbane, Queensland, Australia.

Norton, Robert Arthur (Jun. '28; Assoc. M. '36), Associate Agri. Engr., SCS, U. S. Dept. of Agriculture, Box 114, Clarinda, Iowa.

Robichau, Harold Vincent (Jun. '26; Assoc. M. '36), Structural Designer, Stone & Webster Engr. Corporation, Boston (Res., 1 A Mulberry St., Beverly), Mass.

Scholer, Charles Henry (Assoc. M. '24; M. '36), Prof. and Head of Dept. of Applied Mechanics, Kansas State Coll. of Agriculture and Applied Science, Manhattan, Kans.

Swinton, Roy Stanley (Jun. '11; Assoc. M. '17; M. '36), Asst. Prof., Eng. Mechanics, Univ. of Michigan, Room 308, Eng. Annex, Univ. of Michigan (Res., 1114 Woodlawn Ave.), Ann Arbor, Mich.

Troxell, George Earl (Assoc. M. '24; M. '36), Associate Prof., Civ. Eng., Univ. of California, Berkeley, Calif.

Waddell, John Alexander Low (M. '81; Hon. M. '36), Cons. Engr., 142 Maiden Lane, New York, N.Y.

White, Harold LeRoy (Jun. '28; Assoc. M. '36), Constr. Engr., Am. Concrete and Steel Pipe Co., Rochester Branch, Rochester (Res., 522 Plaza Serena, Ontario), Calif.

Whittaker, Howard James (Jun. '29; Assoc. M. '36), Office and Designing Engr., Essex County Park Comm., 115 Clifton Ave., Newark, N.J.

REINSTATEMENTS

Byrnes, Harry Cady, M., reinstated Oct. 20, 1936.

Rittgers, Virden Acie, Assoc. M., reinstated Apr. 13, 1936.

Smith, Richard Albert, Assoc. M., reinstated Aug. 17, 1936.

RESIGNATIONS

Bushnell, Howard Blaine, M., resigned Oct. 30, 1936.

Green, Charles Henry, Jun., resigned Oct. 22, 1936.

Applications for Admission or Transfer

Condensed Records to Facilitate Comment of Members to Board of Direction

December 1, 1936
Number 12

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every member is urged, therefore, to scan carefully the list of candidates published each month in Civil Engineering *and to furnish the Board with data which may aid in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board.

Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

Grade	General Requirement	Age	Length of Active Practice	Responsible Charge of Work
Member	Qualified to design as well as to direct important work	35 years	12 years*	5 years of important work
Associate Member	Qualified to direct work	27 years	8 years*	1 year
Junior	Qualified for sub-professional work	20 years†	4 years*	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years*	5 years of important work
Fellow	Contributor to the permanent funds of the Society			

* Graduation from an engineering school of recognized reputation is equivalent to 4 years of active practice.

† Membership ceases at age of 33 unless transferred to higher grade.

The fact that applicants refer to certain members does not necessarily mean that such members endorse.

ADMISSIONS

Anglade, Carlos, Caracas, Venezuela. (Age 36.) Delegate of Ministry of Public Works of Venezuela to the Third World Power Conference in Washington, D.C. Refers to E. Aguerrevere, E. Gongora Pareja, J. M. Ibarra Cerezo, T. Saville, J. R. Stubbins.

Avery, Elwood Choate, Ann Arbor, Mich. (Age 32.) Engr. (on appraisal of public utilities), Jensen, Bowen & Farrell. Refers to K. A. Farrell, M. L. Harris, H. K. Hood, O. A. R. V. Jensen, W. Lahde, H. E. Riggs, J. F. Walker.

Barton, Charles Frederick, East Orange, N.J. (Age 29.) Clerk (Asst. Job and Wage Analyst), Consolidated Edison Co. of New York, Inc., New York City. Refers to A. F. Eschenfelder, J. E. Garratt, S. C. Hamilton, Jr., H. A. Haufler, F. Williams, C. A. Winston.

Blewett, Gideon Albert, Ottawa, Kansas. (Age 42.) Refers to W. V. Buck, O. J. Eidmann, C. I. Felps, L. R. Tillotson, R. M. Willis.

Bradley, Walter Schiess, Los Angeles, Calif. (Age 38.) Jun. Civ. Engr., Bureau of Eng., City of Los Angeles. Refers to M. Butler, H. P. Cortelyou, R. M. Fox, L. D. Gifford, W. C. Hogoboom, C. J. Shults, R. W. Stewart.

Brescia, Ralph Nicholas, New York City. (Age 25.) Asst. Engr. of Constr., War Dept. (WPA), 2d Corps Area, Planning Sec., Ft. Jay, Governors Island. Refers to A. M. Anderson, A. Daniels, B. Kriegel, L. H. Lockwood, J. Wilmot.

Chipley, Chesley Allen, Cleburne, Tex. (Age 32.) Res. Engr., Texas State Highway Dept. Refers to H. C. Doremus, F. E. Lovett, J. T. L. McNew, J. J. Richey, H. P. Stockton, Jr., M. C. Welborn.

Cochrane, Joseph Derr, St. Marys, Pa. (Age 30.) With Pennsylvania R.R. Co., Kane, Pa. Refers to W. J. Carroll, H. W. Claybaugh, S. W. Jackson, R. K. Reznor, J. H. Robinson.

Colton, Dudley Teepell, Manville, N.J. (Age 29.) Research Engr., Johns-Manville Research Laboratories. Refers to R. L. Barbehenn, W. C. Brockway, G. M. Fair, E. M. Jenkins, L. J. Johnson, R. W. Sawyer, 3rd, P. A. Voight.

Corbett, James Irving, Providence, R.I. (Age 38.) Associate Engr., U. S. Engr. Office. Refers to G. B. Archibald, C. T. Barker, G. A. Hathaway, W. R. Vawter, P. von Weymarn, W. S. Winn.

Corradi, Peter, Scarsdale, N.Y. (Age 26.) Senior Draftsman, War Dept., Engr. Corps, U. S. Army, New York City. Refers to C. T. Schwarze, R. F. Wheadon.

Cushing, Jerome James, Cambridge, Mass. (Age 22.) At present graduate student, Massachusetts Inst. of Technology. Refers to G. T. Donoghue, W. M. Fife, E. M. Markham, K. C. Reynolds, C. M. Spofford.

Delaney, William Joseph, Millburn, N.J. (Age 35.) Designer, Port of New York Authority, New York City. Refers to O. H. Ammann, A. Dana, J. A. Darling, C. W. Dunham, D. A. Nettleton, C. M. Noble, E. W. Stearns.

Douglas, Clarence Joseph, Loon Lake, N.Y. (Age 29.) Lieut. Engr. (Res.), U. S. Army, CCC work. Refers to G. F. Eckhard, S. L. Fuller.

Dugan, James Henry, New York City. (Age 51.) Engr. of Design, New York City Tunnel Authority. Refers to O. H. Ammann, O. L. Brodie, G. L. Lucas, J. H. Quimby, R. Ridgway, O. Singstad, R. Smillie.

Fleming, James Aloysius, Jr., White Plains, N.Y. (Age 25.) Jun. Field Engr., WPA. Refers to H. P. Barnes, C. T. Schwarze.

Fowlkes, Benjamin Cobb, Jr., Grafton, W.Va. (Age 33.) Officer-in-Chg., Tygart River Reservoir Dam, U. S. Engrs. Refers to R. W. Carlson, J. E. Deignan, J. P. Growdon, W. L. Kuehnle, W. H. McAlpine, P. A. Perrin.

Geltner, Carl, New York City. (Age 23.) Refers to C. T. Schwarze, D. S. Trowbridge.

Gienty, Edward Kenneth, North Conway, N.H. (Age 28.) Jun. Civ. Engr., U. S. Forest Service. Refers to E. W. Bowler, G. W. Case, J. C. Dort, J. R. McDermott, R. R. Skelton.

Glover, Archibald Franklin, Brooklyn, N.Y. (Age 34.) Structural Draftsman, New York City Tunnel Authority. Refers to C. E. Conover, J. Fertik, F. E. Foss, I. J. Lake, W. A. O'Leary, F. A. Rossell, M. H. Van Buren.

Greenwade, Bryan Palmer, Port Arthur, Tex. (Age 32.) Asst. Engr., Texas State Highway Dept. Refers to C. H. Harrison, R. E. Killmer, T. A. Munson, W. A. Ortolani, R. J. Potts, A. B. Staubach.

Guardia, Carlos Alberto, Panama City, Panama. (Age 32.) With Panama Govt. as Chf. of Div. of San. Eng., National Health Dept. Refers to H. G. Arango, G. C. Bunker, T. Guardia, E. H. Magoon, F. R. Molther.

Gutteridge, Alan Gordon, Melbourne, Australia. (Age 44.) Cons. Engr. Refers to J. T. N. Anderson, G. M. Fair, G. Higgins, F. F. Longley, W. H. R. Nimmo, C. W. N. Sexton, H. M. Sherrard.

Halliday, Donald Allan, New York City. (Age 21.) In field office of H. H. Sherwin & Co., Engrs. and Contrs., New York City. Refers to C. T. Schwarze, D. S. Trowbridge.

Haskins, Albert Raymond, Chicago, Ill. (Age 23.) Draftsman, Universal Oil Products Co. Refers to J. G. Bennett, F. G. Gordon, D. C. Jackson, Jr., G. B. Massey.

Holmes, Thomas Hughes, Glendale, Calif. (Age 50.) Engr., War Dept., Los Angeles Engr. Dist. Refers to J. C. Albers, M. B. Case, D. A. MacCrea, R. Modjeski, H. E. Trout, W. R. Weidman.

Huskison, Christian Carll, Phoenix, Ariz. (Age 30.) Office Engr., Plans Div., Arizona Highway Dept. Refers to W. H. Becker, J. Girand, C. E. Griggs, V. H. Housholder, E. V. Miller, C. Myers, J. R. Van Horn.

Jehle, Charles Andrew Peter, Brooklyn, N.Y. (Age 57.) With City of Long Beach, N.Y. Refers to J. B. Martin, O'K. W. Myers, J. Nagel, H. E. Newell, J. A. Ruddy.

Kingsland, Lawrence Myrick, Breckenridge, Tex. (Age 39.) Area Engr., Breckenridge Reservoir Area, Brazos River Conservation & Reclamation Dist. Refers to C. H. Birdseye, R. J. Cummins, E. Haquinius, W. H. Mead, J. A. Norris.

Knapp, Frank Hiram, Safford, Ariz. (Age 49.) Chf. Engr., Gila Project, Arizona-New Mexico,

U. S. Dept. of Agriculture, SCS. Refers to J. W. Beardsley, J. L. Burkholder, D. W. Cole, H. T. Cory, L. M. Lawson, R. I. Meeker, J. L. Savage.

Koenitzer, Lester Henry, Manhattan, Kans. (Age 35.) Asst. Prof., Applied Mechanics Dept., Kansas State Coll. Refers to T. R. Agg, L. E. Conrad, E. R. Dawley, F. F. Frazier, M. W. Furr, C. H. Scholer.

Kuykendall, Aubrey Leon, Terrell, Tex. (Age 28.) Engr.-Inspector, Power & Powell, Engrs. on sewer line construction. Refers to E. Couch, E. L. Myers, E. N. Noyes, W. J. Powell, R. B. Thomas.

Lyon, George Albert, Logan, Utah. (Age 46.) Eng. Inspector, PWA, Logan, Utah. Refers to O. Bundy, M. Housecroft, F. M. Keller, O. C. Lockhart, J. H. Young.

MacLean, Mansell Lehigh, Larchmont, N.Y. (Age 32.) Field Engr., Rosoff Subway Constr. Co., Inc., New York City. Refers to A. E. Clark, A. H. Diamant, H. W. Hudson, C. M. Madden, J. W. Ridgway, F. W. Stiefel.

McNerney, John Joseph, New York City. (Age 23.) Refers to W. E. Brown, R. C. Brumfield, F. E. Foss, G. Morrison, M. H. Van Buren, J. P. J. Williams.

Mellinger, Frank Millin, Zanesville, Ohio. (Age 26.) With Army Engrs., War Dept. Refers to G. E. Beggs, G. Gilboy, N. R. Moore, R. R. Philippe, E. L. Winslow, Jr.

Mengel, Carl Wayne, Chapel Hill, N.C. (Age 47.) Chf. Engr., PWA, North Carolina Office. Refers to L. R. Ames, T. C. Atwood, H. G. Baity, J. L. Becton, T. S. Johnson, S. H. McCrory, W. C. Olsen, W. M Piatt, C. W. Smedberg, G. C. White, S. H. Wright.

Merriman, Chester Frederick, New York City. (Age 32.) Refers to E. D. Dake, A. Diefendorf, R. E. Horton, P. A. Perrin, J. C. Rathbun, T. E. Ringwood, T. Saville.

Metzler, Charles Leroy, Kansas City, Mo. (Age 25.) With Drafting Dept., Black & Veatch, Cons. Engrs. Refers to G. W. Bradshaw, J. O. Jones, W. C. McNown.

Millen, James Adsit, Taft, Calif. (Age 23.) Field Engr., Kern Div., Southern California Gas Co., Los Angeles, Calif. Refers to C. Derleth, Jr., C. G. Hyde.

Moeller, Clifford Merrill, Ogallala, Nebr. (Age 23.) Rodman, Right-of-Way Dept., Central Nebraska Public Power & Irrigation Dist. Refers to M. I. Evinger, R. O. Green, D. H. Harkness, H. J. Kesner, C. E. Mickey.

Morriss, Grover Cleveland, Temple, Tex. (Age 54.) Chf. Cadastral Engr., Brazos River Conservation & Reclamation Dist. Refers to C. H. Birdseye, J. R. Coltharp, E. Haquinius, N. A. Norris, J. W. Pritchett, F. E. Rightor.

O'Farrell, Harry Oliver, Brownsville, Pa. (Age 37.) Constr. Engr. and Mgr., Contr. Div., Brownsville Constr. Co., Inc. Refers to E. W. Cunningham, F. J. Erwin, S. S. Neff, D. K. Orr, P. E. Wylie.

O'Hagan, Henry Patrick, Reno, Nev. (Age 53.) Examining Engr., PWA. Refers to F. T. Crowe, A. R. Eitzen, B. A. Hall, A. E. Holcomb, L. J. Hotchkiss, P. M. Larsen, N. H. Leavitt, E. L. Sutherland.

Page, John Ruffner, Fort Monroe, Va. (Age 26.) Chf. Civ. Eng. Aid, Grade SP-6(CCC). Refers to C. B. Andrews, J. L. Newcomb, E. C. Webster.

Painter, Wilfred Lewis, Seattle, Wash. (Age 28.) Graham & Painter, Ltd., Archts. and Engrs., Seattle and Shanghai. Refers to H. L. Bushnell, R. A. Huestis, C. C. More, E. C. Stocker, M. O. Sylliaasen.

Partain, Alfred William, Corpus Christi, Tex. (Age 33.) Field Engr. with County Engr., Nueces County, Tex. Refers to T. W. Bailey, E. B. Darby, J. S. Fenner, M. Johnson, R. E. Killmer, W. H. Striebeck, Jr., P. G. Young.

Paul, Robert William, Zanesville, Ohio (Age 23.) With U. S. Engrs., Nellie, Ohio. Refers to W. L. Brown, C. H. Lovejoy, C. M. Stewart, A. R. Webb.

Quine, Thomas Arthur, Boulder, Colo. (Age 22.) Refers to R. L. Downing, C. L. Eckel.

Riess, Frank, New Orleans, La. (Age 20.) Refers to D. Derickson, W. B. Gregory.

Rogers, Clarence Fuller, Washington, D.C. (Age 36.) Associate Highway Engr., Div. of Management, U. S. Bureau of Public Roads. Refers to T. W. Allen, C. D. Curtiss, C. L. Eckel, L. N. Edwards, C. E. Mickey, C. Shoemaker, G. H. Taylor.

Santi, Mark Giovacchino, Waco, Tex. (Age 27.) Asst. Engr. Aide, Soil Conservation Service, Texas project. Refers to A. Haring, T. Saville, C. T. Schwarze, D. S. Trowbridge, S. F. Yasines.

Scott, Rodney Jerome, South San Francisco, Calif. (Age 27.) Detailer, Bethlehem Steel Co. Refers to C. D. Curran, J. R. Griffith, W. B. McMillan, F. Merryfield, C. A. Mockmore.

Scoville, John Allen, Philadelphia, Pa. (Age 42.) Lieut. Commander, Civ. Eng. Corps, U. S. Navy. Refers to W. H. Allen, R. E. Bakenhus, G. S. Burrell, G. A. McKay, J. J. Manning, J. T. Mathews, B. Moreell, A. L. Parsons, E. C. Seibert, N. M. Smith, R. M. Warfield, R. Whitman.

Shockley, Woodland Gray, Yellow Springs, Ohio. (Age 22.) Draftsman, Buckeye Incubator Co., Springfield, Ohio. Refers to F. E. Fahy, J. A. K. van Hasselt.

Stratton, James Hobson, Tucumcari, N.Mex. (Age 38.) Capt., Corps of Engrs., U. S. Army, being Eng. Chf., Conchas Dam Project. Refers to J. B. Alexander, H. M. Hill, L. C. Hill, C. S. Joslyn, J. D. Justin, T. T. Knappen, H. Kramer, W. H. McAlpine, G. H. Matthes.

Torreyson, Charles Hail, New Madrid, Mo. (Age 35.) Research Engr., Milwaukee Office, U. S. Bureau of Agricultural Eng., in charge of drainage research in Missouri and Kentucky. Refers to J. H. Brooking, J. T. Campbell, E. T. Davis, L. L. Hidinger, S. H. McCrory, C. W. Okey, F. S. Stow.

Travaini, Dario, Phoenix, Ariz. (Age 33.) Supt. of activated sludge plant, City of Phoenix, Ariz. Refers to J. Girand, C. G. Hyde, W. Johannessen, A. M. Rawn, J. H. Rider, M. R. Tillotson.

Verpillot, Emil Alexander, Westerleigh, N.Y. (Age 36.) Asst. Engr., City of New York Dept. of Plant and Structures, Div. of Ferries. Refers to N. Cummings, I. Delson, J. A. Knighton, E. J. McGrew, Jr., V. H. Reichelt.

Wagener, August Hans, Rochester, N.Y. (Age 37.) With Eng. Dept., City of Rochester, N.Y. Bureau of Maps & Surveys. Refers to W. Bowie, H. L. Howe, W. H. Roberts, J. F. Skinner, E. H. Walker.

Wells, George Ray, Jr., Dormont, Pa. (Age 21.) With Eng. Dept., Peoples Natural Gas Co., Pittsburgh, Pa. Refers to R. P. Davis, W. S. Downs.

Weyher, Theodore Addison, Watertown, Mass. (Age 31.) 1st Lieut., Ordnance Dept., Engrs., U. S. Army. Refers to M. C. Grenata, R. P. Howell, A. L. Lane, W. E. Lorence, E. H. Schulz, G. R. Young.

Yates, Oscar Townsend, Cincinnati, Ohio. (Age 40.) Associate Engr., Div. Engr.'s Office, Ohio River Div., Corps of Engrs. Refers to J. E. Deignan, B. Dibble, H. W. Gregory, J. P. Growdon, W. W. Gwathmey, Jr., C. E. Hammell, J. W. Jones.

FOR TRANSFER

FROM THE GRADE OF ASSOCIATE MEMBER

Doten, Henry Leroy, Assoc. M., Augusta, Maine. (Elected Dec. 22, 1930.) (Age 37.) Constr. Engr., Bridge Div., Maine Highway Comm. Refers to L. N. Edwards, W. S. Evans, F. H. Mason, P. D. Sargent, E. H. Sprague, M. R. Stackpole, B. T. Weston.

Farrisee, William James, Assoc. M., Potsdam, N.Y. (Elected March 5, 1928.) (Age 38.) Associate Prof. of Civ. Eng., Clarkson Coll. of Technology. Refers to E. F. Berry, J. P. Burns, W. B. Carr, C. A. Pohl, S. D. Sarason, B. E. White, F. C. Wilson.

Ferneau, Thomas Edgar, Assoc. M., San Rafael, Calif. (Elected Junior April 18, 1927; Assoc. M. Aug. 27, 1928.) (Age 36.) Res. Engr., Dist. IV, California Div. of Highways. Refers to H. J. Brunnier, C. C. Cottrell, V. A. Endersby, A. S. Gelston, G. Mattis, F. W. Panhorst, G. D. Whittle.

Grathwol, Henry Jacob, Assoc. M., Washington, D.C. (Elected Oct. 14, 1919.) (Age 50.) Associate Highway Engr.; Dist. No. 10, U. S. Dept. of Agriculture, U. S. Bureau of Public Roads. Refers to E. R. Cary, J. C. Dort, A. F. Gordon, B. P. Harrison, F. P. LaBoon, H. J. Spelman, A. C. Toner.

Kunesh, Joseph Francis, Assoc. M., Honolulu, Hawaii. (Elected June 1, 1920.) (Age 46.) Asst. Chf. Engr., Board of Water Supply, City of Honolulu. Refers to H. A. R. Austin, R. S. Charles, F. F. Friend, N. C. Grover, J. C. Hoyt, G. K. Larrison, H. D. McGlashan, D. W. Mead, B. Moreell, G. S. Reeves, B. F. Rush, G. E. P. Smith, S. W. Tay.

Massey, Thomas Holland, Assoc. M., Commerce, Ga. (Elected June 7, 1926.) (Age 39.) Engr. Inspector, PWA. Refers to H. T. Cole, W. A. Hansell, W. D. Hull, J. H. Johnston, M. J. MacNabb, W. S. McDonald, P. Moore, S. B. Slack, H. U. Wallace.

Paul, Ellis Ellsworth, Assoc. M., New York City. (Elected March 14, 1927.) (Age 36.) Asst. Engr. with Ash-Howard-Needles & Tammen, Cons. Engrs., Kansas City, Mo., and New York City. Refers to A. Dana, M. Goodkind, A. T. Granger, E. E. Howard, H. W. Hudson, E. R. Needles, H. C. Tammen, C. D. Weller, C. C. Williams.

Rubins, Ralph Edward, Assoc. M., Minneapolis, Minn. (Elected Junior Oct. 15, 1923; Assoc. M. Dec. 28, 1931.) (Age 36.) Engr., PWA. Refers to E. G. Briggs, W. N. Carey, G. B. DuBois, D. S. Helmick, H. H. Jewell, R. D. Thomas.

Scheidt, Melvin Edgar, Assoc. M., Timonium, Md. (Elected Jan. 17, 1927.) (Age 36.) With FEA of PW, Maryland-Delaware Office, being Asst. to State Director, Baltimore, Md. Refers to J. H. Gregory, G. L. Hall, R. E. Horton, T. F. Hubbard, J. T. Thompson, E. B. Whitman, A. Wolman.

Whyte, Clifford Riddle, Assoc. M., Washington, D.C. (Elected Oct. 10, 1927.) (Age 47.) Engr. of Bridges, District of Columbia. Refers to R. Farnham, J. B. Gordon, C. B. Hunt, J. V. McNary, H. C. Whitehurst.

Williams, Byrd Moore, Jr., Assoc. M., Ft. Worth, Tex. (Elected April 22, 1935.) (Age 53.) Constr. Engr., City of Ft. Worth. Refers to O. E. Carr, J. B. Hawley, D. L. Lewis, A. J. McKenzie, M. C. Nichols, E. W. Robinson, T. U. Taylor.

From the Grade of Junior

Andujar, Anthony Leveridge, Jun., Arkport, N.Y. (Elected Oct. 10, 1927.) (Age 31.) Asst. Res. Engr. Inspector, New York City Office, FEA of PW, Washington, D.C. Refers to E. H. Anson, C. W. Coote, C. B. Ferris, M. M. Liebeskind, C. T. Schwarze, F. W. Schwiers, Jr., A. S. Tuttle.

Angell, Lester William, Jun., Knoxville, Tenn. (Elected July 31, 1933.) (Age 30.) Asst. Structural Engr., TVA. Refers to W. J. Farrisee, P. E. Gisiger, R. F. Hall, W. D. Myers, K. C. Roberts, C. M. Weston, F. C. Wilson.

Berndtson, Bernhardt Taylor, Jun., Oakland, Calif. (Elected Nov. 26, 1934.) (Age 32.)

Jun. Highway Engr., California State Div. of Highways, Dist. III, Marysville, Calif. Refers to N. Aanonsen, H. W. Haberkorn, J. B. Hodges, R. D. Reeve, C. L. Young.

Blaschke, Theodore Oscar, Jun., North Platte, Nebr. (Elected March 11, 1935.) (Age 32.) Structural Designer, Platte Valley Public Power & Irrigation Dist. Refers to J. C. Balcomb, H. A. Foster, E. E. Halmos, P. F. Keim, J. G. Mason, A. L. Ogle, D. D. Price.

Buck, Robinson Dudley, Jun., Hartford, Conn. (Elected Oct. 26, 1931.) (Age 27.) Member of firm Henry Wolcott Buck. Refers to C. J. Bennett, H. L. Blakeslee, R. N. Clark, W. J. Scott, A. L. Shaw, R. H. Suttie.

Camp, Fred Albert, Jun., Bishop, Calif. (Elected Oct. 26, 1931.) (Age 31.) Surveyor's Aid, Dept. of Water & Power, Los Angeles and Mono Basin Project. Refers to E. A. Bayley, H. P. Bliss, N. M. Imbertson, H. L. Jacques, R. D. Reeve, L. C. Rogers, A. E. Sedgwick.

Collier, Erwin Tilden, Jun., Tampa, Fla. (Elected Oct. 14, 1929.) (Age 31.) Project Engr., Florida State Road Dept. Refers to D. Brown, C. B. Cooke, W. A. Hadley, H. J. Morrison, J. R. Slade.

Flynn, John Kelly, Jun., New York City. (Elected Jan. 13, 1930.) (Age 28.) Senior Eng. Aide, New York State Dept. of Public Works. Refers to L. W. Clark, L. T. Howard, J. Knickerbacker, T. R. Lawson, H. Ryon.

Holmes, Joseph Mark, Jun., Washington, D.C. (Elected April 30, 1934.) (Age 32.) Asst. Engr., U. S. Geological Survey. Refers to G. D. Clyde, H. H. Hodgeson, O. W. Israelsen, C. L. Sadler, J. G. Staack.

Hussey, Edgar William, Jun., Portland, Ore. (Elected Oct. 10, 1927.) (Age 32.) Sales Engr., Soule Steel Co. Refers to W. S. Kingsbury, Jr., D. R. McFarland, W. J. Manetta, S. B. Morris, C. E. Pearce, C. W. Sopp, E. L. Soule.

Jonsson, Alex Carl, Jun., Los Angeles, Calif. (Elected Oct. 29, 1934.) (Age 32.) Asst. Supt., Metropolitan Water Dist. of Southern California. Refers to J. B. Bond, R. C. Booth, R. E. Davis, R. B. Kiemer, H. G. Matthews.

Kurtossy, Roger Gabriel, Jun., Hollywood, Calif. (Elected June 9, 1930.) (Age 32.) Bldg. Contr. Refers to L. A. Ball, A. Haring, E. C. LaValley, C. T. Schwarze, H. I. Stites, D. S. Trowbridge.

Latimer, Marion Millard, Jun., Utica, Ill. (Elected Nov. 11, 1929.) (Age 32.) With National Park Service, Dept. of Interior, Washington, D.C., as Senior Project Supt., Starved Rock Slate Park. Refers to W. K. Hatt, E. C. Heinrich, F. Hendershot, C. Jenkins, G. E. Lommel, G. E. Oliver, W. M. Smith.

Letourneau, Doria George, Jun., Sargentville, Maine. (Elected Nov. 14, 1927.) (Age 31.) Res. Engr., Robinson & Steinman, New York City. Refers to R. Boblow, E. W. Bowler, C. B. Breed, R. E. Reed, H. D. Robinson, C. M. Spofford, D. B. Steinman.

Lindblom, Clifford Theodore, Jun., Cincinnati, Ohio. (Elected Nov. 10, 1930.) (Age 32.) Associate Engr., U. S. Engr. Office. Refers to A. L. Alin, R. A. Anderegg, F. B. Duis, C. L. Hall, C. E. Hammell, R. W. Renn, W. S. Winn.

Markle, Harry Atkins, Jr., Jun., Allentown, Pa. (Elected Oct. 14, 1930.) (Age 29.) Project Engr., Pennsylvania Dept. of Highways. Refers to V. M. Anckaitis, C. H. Buckius, C. E. Carter, C. L. Harris, R. E. Neumeyer.

Petrofesi, Michael Francis, Jun., New York City. (Elected Oct. 1, 1928.) (Age 32.) Engr., Armory Board Project, being Asst. in charge of Structural Dept. Refers to C. E. Beam, J. J. Costa, R. H. Gould, N. I. Kass, F. A. Rossell.

Potts, Clifford Bernard, Jun., Vernon, Ariz. (Elected Oct. 30, 1933.) (Age 32.) Officeman, Arizona Highway Dept. Refers to H. A. Alderton, Jr., H. J. Gault, F. N. Grant, G. L. McLane, W. J. Nelson, S. Smyth.

Sporseen, Stanley Emanuel, Jun., Bonneville, Ore. (Elected Oct. 30, 1931.) (Age 32.) Jun. Engr., U. S. Engrs. Refers to A. Bauer, N. W. Haner, C. W. Kimbrough, W. W. Laxton, C. C. More, B. E. Torpen, R. B. Van Horn.

Tio y Nazario de Figueroa, Aurelio, Jun., San German, Puerto Rico. (Elected March 11, 1929.) (Age 29.) Contr. for Puerto Rico Reconstruction Administration Building Plan. Industry Bldg., Mayaguez, Puerto Rico, Refers to M. Font, F. Fortuno-Selles, F. Pons A. S. Romero, E. Totti y Torres.

Tomlinson, Henry Hansell, Jun., Philadelphia, Pa. (Elected Dec. 3, 1926.) (Age 32.) Member of firm, Widdicombe Eng. Co., Structural Engrs. and Contrs. Refers to J. R. Farrell, B. F. Hastings, L. L. Lessig, J. W. Townsend, Jr., I. S. Towsley, S. H. Widdicombe, F. P. Witmer.

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

Men Available

These items are from information furnished by the Engineering Societies Employment Service, with offices in Chicago, New York, and San Francisco. The service is available to all members of the contributing societies. A complete statement of the procedure, the location of offices, and the fee is to be found on page 87 of the 1936 Year Book of the Society. To expedite publication, notices should be sent direct to the Employment Service, 31 West 39th Street, New York, N.Y. Employers should address replies to the key number, care of the New York Office, unless the word Chicago or San Francisco follows the key number, when it should be sent to the office designated.

Construction

Civil Engineer; Assoc. M. Am. Soc. C.E.; 29; single; graduate of New York University, 1930. Registered professional engineer, New York; 5 years with contractor on subway and vehicular tunnels. Field engineer and assistant to chief engineer on subsurface construction, in compressed air, hydrographic dredging, surveying, etc. Desires work with contractor on new construction. Employed. Available on short notice. D-1921.

Civil Engineer; Jun. Am. Soc. C.E.; 29; single; B.S.C.E. degree; $1\frac{1}{2}$ years surveying experience; office and field work; 6 months engineering experience on water line; storm-sewer and road construction; 3 years drafting experience—layout and detailing. D-5344.

Design

Structural Engineer; Assoc. M. Am. Soc. C.E.; B.S., C.E.; professional engineer's license in the state of New York. Experienced in the design and supervision of industrial and public buildings, among which are some of the tallest structures in New York City. Expert mathematician. Best references. B-5606.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 36; New York license; 8 years in design, estimating, and construction with general contractors on heavy construction projects and extension of power system; 8 years insurance brokerage. Knowledge of business principles and organization. Desires connection with future. Location immaterial. D-4964.

Structural Engineer; Assoc. M. Am. Soc. C.E.; 41; married; licensed professional engineer, New York and New Jersey; 9 years with one company in charge of design and details of fireproof floor systems; 12 years experience in building and structural design—steel, reinforced concrete, and timber. Foundations; rigid-frame structures. Excellent draftsman. Desires connection with future. B-7608.

Assistant Structural Engineer, Bonneville Project; Assoc. M. Am. Soc. C.E.; with U. S. Engineers; 16 years experience on highways, rivers and harbors, structural design, building construction, public utilities, railroad location, hydraulics, and administration; seeks employment on Pacific coast or in Western states; graduate of University of Washington; 44 years old; Washington license. D-5231.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 23 years experience; 2 degrees. Design, surveying, estimating for contractor. Factories, railroads, housing, real estate development. A-2505.

Executive

Technically Trained Executive; Assoc. M. Am. Soc. C.E.; general administrative experience—organization and management—including business, plant, property and estate management; plant maintenance, production, and personnel; economic studies, company reorganizations and amalgamations, and valuations; highway, hydroelectric, pulp, newsprint, housing, industrial surveys, investigations, and construction. B.Sc. degree in engineering; age 48; married; Canadian. Location immaterial. B-8743.

Civil Engineer; M. Am. Soc. C.E.; completing assignment as chief engineer of small Southern railroad; will go anywhere for a worthwhile job either as engineer or in administrative or supervisory capacity. Experienced in railway location, construction, valuation, and maintenance; dredging; dams; and general engineering and heavy contracting. C-9464.

Civil Engineer; M. Am. Soc. C.E.; married; 25 years diversified experience, excavation, masonry, foundations, sewers, structural steel, and bridge work; estimating, making and checking plans, and supervising construction. Desires connection with engineering organization or with contractor on construction, working either for straight salary or salary and percentage of profits. Available immediately. B-4134.

Civil and Structural Engineer; Assoc. M. Am. Soc. C.E.; 38; married; graduate; registered civil-structural engineer; land surveyor; 14 years varied experience, including surveying, highway design and construction, railroad grade separations and bridges, municipal paving, sewer design and construction, building design, and valuation work. Desires permanent civil engineering position. Available on short notice. D-5523.

Civil Engineer; M. Am. Soc. C.E.; graduate; married; 10 years varied experience on drainage surveys, railroad construction, design of structures, mass transportation studies, and extensive valuation; 20 years with property as engineer maintenance of way and structures directing entire office and construction forces including large railway rehabilitation program. Central states preferred. Available immediately. A-1864.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 45; single; graduate; New York state license; 15 years experience in design of industrial and office buildings, power plants, bridges, railroad and harbor structures, and foundations; 5 years construction work as resident engineer. Desires connection with active engineering organization; will also consider going abroad. Now employed; available on two weeks notice. C-428.

Structural Engineer; M. Am. Soc. C.E.; registered engineer, Pennsylvania; estimating, design, and sales of steel-fabricating business in the Ohio, Pennsylvania, and West Virginia territory. Detailed information gladly furnished. C-5095.

Junior

Civil Engineer; Jun. Am. Soc. C.E.; college graduate; 10 years practical experience; private license to fly; knowledge of aerial photography and aerial mapping. Desires position either as an engineer or in some phase of aerial mapping. Employed now; available in two weeks. D-2211.

Civil Engineer; Jun. Am. Soc. C.E.; 28; single; B.S., C.E., Union College, 1929; 6 years engineering experience, including 4 months highway construction, 2 1/2 years office and field work (large building construction firm), 3 years varied engineering experience in general construction, and special course in structural welding design. Desires position in any branch of civil engineering. Available. D-189.

Civil Engineer; Jun. Am. Soc. C.E.; 30; married; B.S., C.E., Rutgers University, 1930; 2 years transitman with Essex County Highway Department. Desires opportunity in any branch of civil engineering. Will go anywhere in New Jersey and neighboring states. Available in 15 days. D-663.

Civil Engineer; Jun. Am. Soc. C.E.; 21; single; B.S. in C.E., Worcester Polytechnic Institute, 1935; 4 months experience with civil engineering firm in Providence, R.I.; 7 months experience as a mechanical engineer. Desires opportunity with some firm engaged in structural design work. Employed now. Available one week after notice of placement. D-5347.

Sanitary Engineer; Jun. Am. Soc. C.E.; 24; single; Christian; B.S. in C.E., Yale University, 1935; M.S., sanitary engineering, Harvard University, 1936; desires opportunity as sanitary chemist, or in design, plant operation, pollution studies, research, etc.; willing to work hard; excellent recommendations. Available immediately. D-5377.

Civil Engineer; Jun. Am. Soc. C.E.; 24; married; B.S. in C.E., Purdue University, 1935. Now employed on project soon to be completed. Desires position that will be permanent and with opportunity for advancement. Location and starting salary secondary. Available in seven days, if necessary. D-5381.

Civil Engineer; Jun. Am. Soc. C.E.; 25; single; licensed surveyor, New Jersey; 2 years surveying (general and precise); 1 1/2 years U. S. Department of Agriculture as junior agricultural engineer. Desires opportunity of making a new connection. D-3316.

Civil Engineer; Jun. Am. Soc. C.E.; 21; B.S., C.E., New York University, 1936; 2 years tutoring surveying while in college, also photoelastic research work. Desires position in construction, sales, teaching, or research. D-5423.

Recent Graduate; Jun. Am. Soc. C.E.; single; 23; Christian; B.S. in C.E., Cooper Union, 1936; architectural graduate, Brooklyn Technical High School; attending New York University at present; desires position in engineering organization; outside or inside work. Location immaterial. D-3683.

Civil Engineer; Jun. Am. Soc. C.E.; 24; single; B.S. in C.E., Bucknell University, 1935; 1 1/2 years railroad maintenance; 6 months street paving and sewer construction; knowledge of French, Italian, and Spanish; familiar with foreign labor; desires permanent position with opportunity, preferably in construction or structural field. Available on two weeks notice. Location mmaterial. D-5522.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1936. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

American Planning and Civic Annual. Edited by Harlean James. Washington, D.C., American Planning and Civic Association (901 Union Trust Building), 1936. 440 pp., illus., tables, 9 × 6 in., cloth, $3 (extra copies $2 to members and subscribers).

This record of recent civic advance includes the proceedings of the joint conference on planning, held at Richmond, Va., May 4–6, 1936; selected papers from the conference on the National Park Service, held in Washington, D.C., January 22–24, 1936; the state park regional conferences, held in Minnesota, September 22–28, 1935, and in Alabama, April 2–4, 1936; and the national conference on state parks, held at Hartford, Conn., June 1–3, 1936.

Cugle's Two-Minute Azimuths. By C. H. Cugle. New York, E. P. Dutton & Co., 1936. 603 pp., tables, cloth, $6.

This table covers latitudes of 35 to 65 deg and declinations of 0 to 23 deg, and supplements the earlier volume, which embraced the latitudes from 0 to 35 deg. The tables are printed in large, clear type and are computed to two-minute intervals, which remove any need for interpolations.

Descriptive Geometry Problem Book. By F. W. Bubb. New York, Macmillan Co., 1936. Diagrs., 8 × 11 in., paper, $1.75.

This book contains 300 problems, laid out upon detachable sheets of white paper. The arrangement follows the development shown in the author's *Descriptive Geometry*, but the problem book can be used with any standard text.

Engineering Geology, 5 ed. By H. Ries and T. L. Watson. 5 ed. New York, John Wiley & Sons, 1936. 750 pp., illus., diagrs., charts, maps, tables, 9 × 6 in., cloth, $5.

A presentation of those fundamental principles of geology which relate to engineering problems, such as the character and structure of rocks, their use in building and their relation to tunneling, dam sites, etc.; the geological conditions that affect underground waters; land slides, deposits of minerals, etc. This edition has been revised, and new bibliographic references added.

Field Engineering, a Handbook of the Theory and Practice of Railway Surveying, Location, and Construction. Vol. 1, Text. By W. H. Searles. 21 ed. Revised and enlarged by H. C. Ives. New York, John Wiley & Sons, 1936. 403 pp., diagrs., charts, tables, leather, 7 × 4 in., $4.

The principal changes in the text of this edition are that the chapter on "String Lining Curves" is by Prof. Philip Kissam, and that the chapter on "Highway Curves" has been entirely rewritten. The tables have been improved and tables of "corrections for subchord lengths" and of the "elevation of the outer rail in inches" are given. These changes add to the usefulness of the standard handbook of railway engineering.

Great Britain, Dept. of Scientific and Industrial Research, Final Report of the Steel Structures Research Committee. London, His Majesty's Stationery Office, 1936. 572 pp., illus., diagrs., charts, tables, 10 × 6 in., paper, 12s. 6d. (Obtainable from British Library of Information, $3.40).

The committee was appointed in 1929, its principal objective being to formulate rules for the design of the steel framework of multi-story buildings of a more exact character than those implied in existing conventional codes. This final report reviews the work done and also presents the results of several important investigations: The stress distribution in the steel frames of a modern hotel and a modern office building; a review of tests on three existing buildings; further investigations of beam and stanchion connections encased in concrete; the analysis and design of beams under given end restraints; further investigations on bolts and bolted joints; the effect of wind loads on frames with semi-rigid connections; the behavior of a pillar forming part of a continuous member in a building frame; a study of critical loading conditions in building frames; and the design of stanchions in building frames. Finally, recommendations for design are given.

Handbook of Engineering Fundamentals. (Wiley Engineering Handbook Series, Vol. 1.) Edited by O. W. Eshbach. New York and London, John Wiley & Sons, 1936. 1081 pp., diagrs., charts, tables, 9 × 6 in., leather, $5.

This is the first volume in the proposed new "Wiley engineering handbook series." It is intended to be a companion to any other volume of the series, in which will be found those fundamental laws and theories of science that are basic to engineering practice. The volume is essentially a summary of the principles of mathematics, physics, and chemistry, the properties and uses of materials, the mechanics of solids and fluids, and the commonly used mathematical tables. A discussion of contractual relations is included.

Hydraulics. By C. W. Harris. New York, John Wiley & Sons, 1936. 220 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $2.75.

The aim of this textbook is to provide a more scientific introduction to the subject than is usually attempted, and to present the various principles in the relationship most commonly encountered in engineering practice. Special emphasis is given to energy transfer and to cause and effect in general. Attention is given to the historic and scientific background, but at the same time the trends of modern industry are considered.

Industrial Dust. By P. Drinker and T. Hatch. New York and London, McGraw-Hill Book Co., 1936. 316 pp., illus. diagrs., charts, tables, 9 × 6 in., cloth, $4.

This book discusses various phases of the problem of dust control in its relation to the health of workmen, emphasizing the cooperative nature of the problem as one for both engineers and physicians, and presenting principles and methods for designing and operating dust-control equipment. Among the subjects considered are the physical asepcts of dust and fume suspensions and their effect upon man; the analysis, measurement, and microscopy of fine dusts; the practical control of dusts; and the use of dust respirators.

Mitteilungen des Hydraulischen Instituts der Technischen Hochschule, München, Heft 8. Edited by D. Thoma. Munich and Berlin, R. Oldenbourg, 1936. 98 pp., illus., diagrs., charts, tables, 11 × 8 in., paper, 7.50 rm.

This publication contains four communications from the Institute. The first describes work with a throttling device for pipe lines, which has no moving parts and provides much greater opposition to counterflow than the normal flow. The second paper describes tests throughout the entire range to complete cavitation. The third paper describes tests upon various types of weirs, especially under conditions of high tail-water level. The final report discusses the vibration of bodies in fluids, such as those of electric lines in the wind.

National Transportation Policy. By C. S. Duncan. New York and London, D. Appleton-Century Co., 1936. 315 pp., tables, 8 × 5 in., cloth, $3.

The author of this book, as an economist in the employ of the Association of American Railroads, has for some years studied the problems that have their source in the competitive relationships between different agencies of transportation. He here presents the results of his experience. The relations between the great transportation agencies, railroads, highways, waterways, pipelines, and airways, are discussed, and a policy is outlined for adjusting them to each other and establishing a proper relationship.

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BRIDGES

Concrete, Freeport, Ill. Modernism in Bridge Design Reflected in Rigid-Frame Span, M. Ipsen. *Eng. News-Rec.*, vol. 115, no. 19, Nov. 7, 1935, pp. 647–648. Features of concrete-arch rigid-frame bridge, with 70-ft span, at Freeport, Ill.; portion of deck near abutments is of solid section, while rest of deck is of ribbed construction.

Concrete Girder, New Zealand. Carlton Bridge, Christchurch, New Zealand, W. G. Morrison. *Instn. Civ. Engrs.—Selected Eng. Papers*, no. 157, 1934, 20 pp. Design and construction of concrete-girder highway bridge, with 50-ft span; comparative discussions of pile-driving formulas; cost data.

Girders, Welded Steel. Arc-Welded Bridge Girders Tested to Failure, L. Grover. *Eng. News-Rec.*, vol. 115, no. 12, Sept. 19, 1935, pp. 392–394. Results of tests by Kansas Highway Commission; two 54-in. plate girders, 27 ft long, with butt-welded flange splices, exhibiting no distress in welds and good stress distribution among component parts up to point of failure.

Railroad Construction, Embankments. Missouri Pacific Completes Filling of 53 Trestles. *Ry. Age*, vol. 99, no. 15, Oct. 12, 1935, pp. 456–458 and 468. During the past 18 years, 4.5 miles of frame trestles in the Ozark Mountains have been replaced by embankments involving the placing of 4,338,000 cu yd of filling material.

Steel. Progress in Welding Large Railway Bridges, O. Bondy. *Ry. Gaz.*, vol. 63, no. 13, Sept. 27, 1935, pp. 492–496. Bridge carrying German State Railway over strait between Stralsund and Isle of Ruegen is largest plate girder bridge built by welding; represents important advances in welding practice and in testing of welds.

Steel, Construction. Steel Erection on Honore Mercier Bridge. *Eng. & Contract Rec.*, vol. 48, no. 29, July 18, 1934, pp. 630–633. Saddle device used to facilitate cantilever erection of deck spans; main span erected as two cantilevers with center closure; hazardous erection of one anchor arm.

Steel, Welding. Planning Arc Welded Bridge Construction, L. Grover. *Am. Welding Soc.—J.*, vol. 14, no. 9, Sept. 1935, pp. 21–25. Design of all-welded continuous-girder viaduct in Kansas City.

Steel Truss, Nigeria. Construction of Bridge Over River Benue at Makurdi, Nigeria, W. E. Thomas. *Instn. Civ. Engrs.—Selected Eng. Papers*, no. 166, 1934, 21 pp., 1 supp. sheet. Details of single-track steel-truss railroad bridge, consisting of 13 spans from 180 to 240 ft in length and totaling 2,584 ft.

Suspension, Anchorages. Cable Anchorages San Francisco–Oakland Bridge, C. H. Purcell, C. E. Andrew, and G. B. Woodruff. *Eng. News-Rec.*, vol. 115, no. 18, Oct. 31, 1935, pp. 593–596. Cellular concrete vertical cantilever, 92 by 197 ft, extending 220 ft below and 280 ft above water, to serve as anchorage at junction of two long suspension bridges, to resist any unbalance in pull of cables which comes to it from opposite directions; earthquake allowance 0.1 g; anchorages on land take advantage of rock weight; stress analysis.

Viaducts, Railroad. Illinois Central Rebuilds 4,000 Ft of Viaduct. *Ry. Age*, vol. 99, no. 14, Oct. 5, 1935, pp. 426–430. Description of work on project at Cairo, Ill., where approaches to this road's bridge across the Ohio River were replaced after 45 years of service, comprising total of 4,000 ft of single-track steel structure.

Wooden, Concrete Deck. Concrete Decks Extend Life of Old Timber Trestles, L. C. Winterton. *Eng. News-Rec.*, vol. 115, no 8, Aug. 22, 1935, p. 264. Description of concrete deck 4 in. thick, placed on subfloor of 2-in. creosoted lumber in repairing six creosoted timber bridges—total length 2,890 ft—across tidal marsh between east and west forks of Pascagoula River, Jackson County, Mississippi.

BUILDINGS

Earthquake Effects. Il terremoto del 10 marzo 1933 a Long Beach. Effetti sugli edifici intelaiati in acciaio o in cemento armato, S. Marletta. *Annali dei Lavori Pubblici*, vol. 72, no. 9, Sept. 1934, pp. 745–778, 1 supp. plate. Report on Long Beach, Calif., earthquake of Mar. 10, 1933, with special reference to its effect on steel and reinforced concrete buildings.

Earthquake Resistance. San Francisco Mint Design to Resist Earthquakes, J. J. Creskoff. *Eng. News-Rec.*, vol. 115, no. 14, Oct. 3, 1935, pp. 466–469. Design of 3-story building occupying area of 208 ft by 185 ft; investigation of periods of vibration of site preceded design of integrated foundation and rigid symmetrical frame; design analyzed by both dynamic and static methods; corner buttresses and beam-to-column connections proportioned to resist earthquake stresses; seismic moments and shears; periods of vibration of building.

Foundations. Shoring, F. G. H. Heuser. *Instn. Mun. & County Engrs.—J.*, vol. 61, no. 17, Feb. 12, 1935, pp. 878–888. Practical construction of underpinning structures for buildings 3 or 4 stories high.

Steel, Stability. Stability of Tall Building Frames, E. H. Bateman. *Instn. Civ. Engrs.—Selected Eng. Papers*, no. 167, 1934, 49 pp. Theoretical analysis based on principle of least work; effect of horizontal and vertical loads.

CITY AND REGIONAL PLANNING

Cities and Towns, Improvement. New Brighton Improvements, L. St. G. Wilkinson. *Liverpool Eng. Soc.—Trans.*, vol. 56, 1935, pp. 125–150, (discussion) 151–158. Commentary on works authorized by bill approved in 1927, including scheme of sea wall, promenade, and foreshore development extending from near pier, New Brighton, to point 300 yd west of Harrison Drive.

Slums. Slum Clearance in Liverpool. *Roy. Inst. Brit. Architects—J.*, vol. 42, no. 20, Oct. 12, 1935, pp. 1136–1141. Housing policy; particulars of St. Andrew's Gardens; site and layout; structure; equipment; finishes.

CIVIL ENGINEERING

Great Britain. Construction in England. *Eng. News-Rec.*, vol. 115, no. 18, Oct. 31, 1935, pp. 597–600. Brief reports on river and drainage work being carried out by catchment boards; scheme developed for demolition of Waterloo Bridge without interfering with river traffic; design of bell tower of Liverpool Cathedral presenting unusual structural problem; port work at Southampton.

CONCRETE

Cement, Pozzuolan. Possibilities of Pozzuolanas in Mortars and Concretes, E. W. Scripture, Jr. *Eng. News-Rec.*, vol. 115, no. 17, Oct. 24, 1935, pp. 563–567. Advantages and pitfalls in use of pozzuolans; test results which permitted reduced water-cement ratio while increasing workability; lime absorption; use of pozzuolan as blend or admixture; effects of early shrinkage; influence on concrete properties; volume-change relations; corrosion resistance; freezing damage; selecting pozzuolans.

Design. Study for Economic Designs in Concrete for Culverts—Short Rural Bridges—Earth-Covered Arches and Retaining Walls, E. G. Harris. *Univ. Missouri School Mines & Met.—Bul. Tech. Series*, vol. 12, no. 1, Mar. 1935, 84 pp. Economics of rural highway bridges of reinforced concrete; flat-slab bridge; side girder bridge; comparative costs; economic culvert design; reinforced concrete retaining walls; cantilever, anchored-counterfort, vertical-beam, and arched retaining walls.

Efflorescence. Efflorescence in Concrete. *Cement & Cement Manufacture*, vol. 8, no. 9, Sept. 1935, pp. 230–231. Efflorescence caused by excessive dampness; conditions favoring formation of efflorescence; substances for reducing possibility of efflorescence.

CONSTRUCTION INDUSTRY

Costs. Current Construction Unit Prices. *Eng. News-Rec.*, vol. 115, no. 15, Oct. 10, 1935, pp. 523–524. Unit cost bids on construction of new $1,500,000 water supply system for Ft. Smith, Ark.; 900-ft earth dam, 180 ft in height above river bed, across North Platte River at Alcova, Wyo.; 11 steel railroad-bridge superstructures in Muskingum Valley, Ohio, flood control district.

DAMS

Concrete Gravity, Failures. Molare Dam in Italy Fails in High Flood. *Eng. News-Rec.*, vol. 115, no. 8, Aug. 22, 1935, pp. 272–273. Description of curved concrete-gravity dam 150 ft high, provided with 12 automatic siphon spillways, also speculation as to causes of its failure following cloudburst of very unusual intensity.

Concrete Gravity, Tennessee. Wheeler Dam Construction Enters Final Year. *Eng. News-Rec.*, vol. 115, no. 8, Aug. 22, 1935, pp. 258–261. Review of construction methods and progress in excavating 550,000 cu yd of rock and placing 650,000 cu yd of concrete in building dam 1$^{1}/_{4}$ miles long on Tennessee River; grouting of foundation; dredging concrete materials.

Construction, Materials Handling. Finished Material for Bonneville Dam Taken Forty Miles to Storage, H. W. Young. *Pit & Quarry*, vol. 27, no. 11, May 1935, pp. 24–27. Methods of handling materials for power and navigation project of Public Works Administration; barge, conveyor, railway, cableway, and cement pumps provide transportation.

Earth, Utah. Moon Lake Dam Will Raise Lake Level 55 Ft. *Western Construction News*, vol. 9, no. 12, Dec. 1934, pp. 382–384. Design of earth and rock-fill dam, 105 ft maximum height, which will raise level of Moon Lake in northeastern Utah by 55 ft, providing storage of 30,000 acre-ft to be used for irrigation; design of spillway with capacity of 10,000 cu ft per sec; also outlet works.

Hydraulic Fill, Texas. Varied Character of Foundation Rock Delays Work on Red Bluff Dam. *Eng. News-Rec.*, vol. 115, no. 15, Oct. 10, 1935, p. 515. Difficulties in construction of Red Bluff Dam on Pecos River; dam is to be semi-hydraulic earth fill, 9,150 ft long; height above river bed, 104 ft; maximum width of base, 555 ft; width of crown, 30 ft.

FLOOD CONTROL

East St. Louis, Ill. Cahokia Creek Diversion and East St. Louis Drainage, H. Shifrin. *Eng. News-Rec.*, vol. 115, no. 16, Oct. 17, 1935, pp. 523–529. Prevention of floods in East St. Louis, Ill., by putting lower 4-mile section of Cahokia Creek into 2-mile diversion and outfall, composed in part of open channel and

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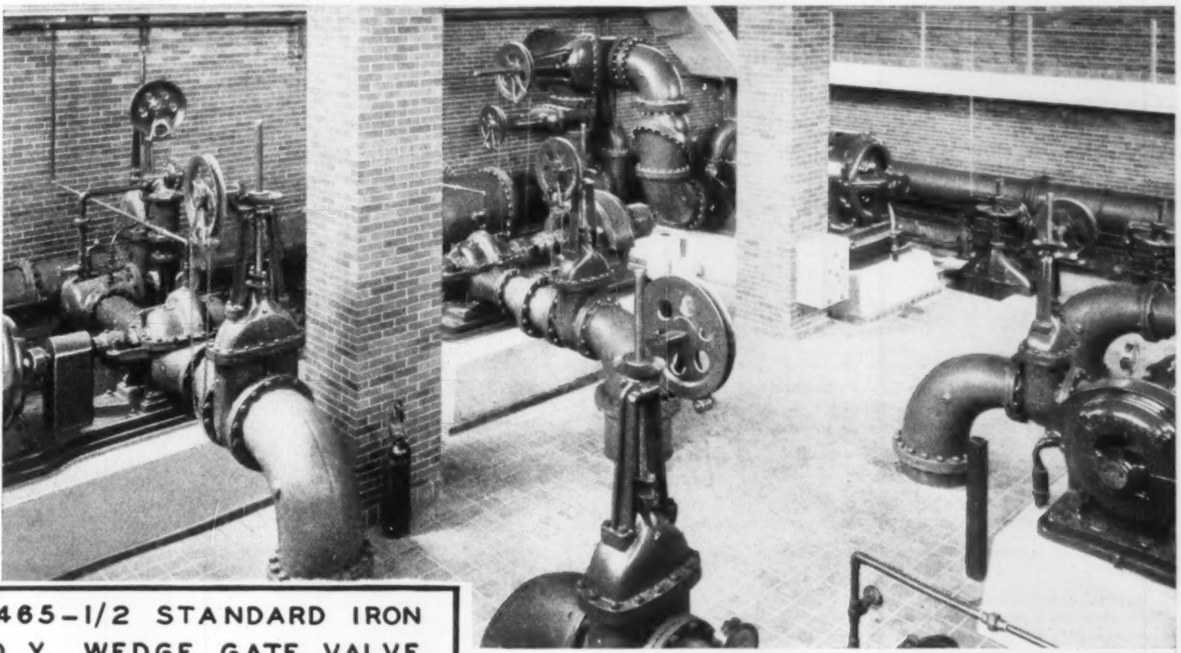

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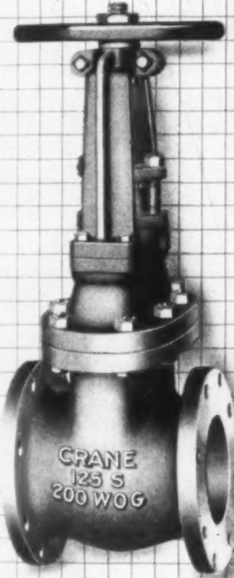

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in part of triple-box conduit having capacity of 2,000 cu ft per sec; Diesel-driven pumping station with capacity of 1,070 cu ft per sec will be located at outlet through levee skirting Mississippi River; all concrete pumped from central plants.

Stream Flow, Great Britain. River Flow Records. *Engineer*, vol. 160, no. 4160, Oct. 4, 1935, p. 348. Reference, but not reproduction of diagrams for river Dee, prepared by River Flow Records, London; during floods measurements were carried on night and day.

FOUNDATIONS

Bridge Piers. What About Your Foundations? *Ry. Eng. & Maintenance*, vol. 31, no. 10, Oct. 1935, pp. 572–575, and 577. Commentary on extensive underwater inspection of bridge substructures, carried on during last few years by Central Region of Canadian National, during course of which it has developed two expert diving organizations and devised and utilized number of unique and effective methods.

Bridge Piers, Construction. Battling Storm and Tide in Founding Golden Gate Pier, R. G. Cone. *Eng. News-Rec.*, vol. 115, no. 8, Aug. 22 1935, pp. 245–251. Exceptional difficulties overcome in building south pier of Golden Gate Bridge in deep water, powerful tidal currents, and frequent violent storms; development of construction plan; plans for fender ring; full-height pouring; final design for concrete forms; fender seal and caisson.

Bridge Piers, Excavation. San Francisco Pier and Anchorage for Transbay Bridge, J. C. Marthens. *Western Construction News*, vol. 9, no. 11, Nov. 1934, pp. 348–352. Excavation and concreting methods on three piers, anchorage block, and Rincon Hill viaduct for $78,000,000 San Francisco–Oakland Bay Bridge; concreting plant.

Bridge Piers, Failure. Earth Pressure Tilts Pier of Grand Coulee Bridge. *Eng. News-Rec.*, vol. 115, no. 19, Nov. 7, 1935, pp. 666–667. Movement of concrete pier while supporting one-half of 950-ft steel cantilever bridge, throws further light on treacherous sliding tendencies of glacial material.

Geophysics. Searching for Foundation Beds by Electricity and Sound, E. R. Shepard. *Eng. News-Rec.*, vol. 115, no. 7, Aug. 15, 1935, pp. 228–232. Outline of principles and description of simplified portable apparatus for earth-resistivity and seismic subsurface surveys for determining depth to rock.

HYDRAULIC ENGINEERING

History. Merrimack Valley Hydraulic Engineers, A. T. Safford. *Boston Soc. Civ. Engrs.—J.*, vol. 22, no. 2, Apr. 1935, pp. 67–100. Early models of water wheels; early hydraulic engineers; water measurements at Lowell; methods of measurement; fundamental laws of hydraulics; conditions for application of formulas and constants in check measurements; power developed at Lowell; Francis' diverging tube; experiments at Swamp Locks, Lowell; channel flows; water wheel settings; flaring draft tubes; design of installations; experimental data.

Hydraulic Structures, Seepage. Method of Determining Flow-Net in Soil Seepage, M. G. Ionides. *Engineering*, vol. 140, no. 3633, Aug. 30, 1935, pp. 211–212. Illustrated example of apparatus which writer has used, suitable for structures subject to small head; having recorded lines of flow, uplift line is found.

Laboratories, China. Hydraulic Laboratory Established in China to Study River Control and Erosion. *Eng. News-Rec.*, vol. 115, no. 14, Oct. 3, 1935, p. 463. Brief description of national hydraulic experiment station at Hopei Institute of Technology in Tientsin.

HYDROLOGY, METEOROLOGY, AND SEISMOGRAPHY

Geology, Oklahoma. Apparent Recent Crustal Movement at Western End of Ouachita Mountains, Oklahoma, M. M. Knechtel and H. E. Rothrock. *Am. Assn. Petroleum Geologists—Bul.*, vol. 19, no. 8, Aug. 1935, pp. 1219–1225. Water and sewer mains in Atoka, Okla., have given trouble by breaking repeatedly at points where they cross outcrop of inclined sandstone beds; points at which ruptures occur are along straight line; it appears that phenomena are due to faulting, though no earthquakes have been felt in immediate neighborhood.

Rain and Rainfall, South Africa. Recent Remarkable Rains in Southern Rhodesia, with Certain Deductions as to Probable Maximum Floods, R. H. Roberts. *Instn. Civ. Engrs.—Selected Eng. Papers*, no. 159, 1934, 41 pp. Study of rainfall distribution, intensity of rain storms, and probability of flood run-offs.

INLAND WATERWAYS

Panama Canal. Engineer's Recollections—X. Early Days at Panama, J. F. Stevens. *Eng. News-Rec.*, vol. 115, no. 8, Aug. 22, 1935, pp. 255–257. Initial efforts concentrated on erection of proper shelter for construction forces, provision of adequate water supply and sewage-disposal facilities, and creation of commissary department.

Rivers, Improvement. Effective River Control by Concrete Tetrahedrons. *Eng. News-Rec.*, vol. 115, no. 14, Oct. 3, 1935, pp. 470–471. Service lives of 5 years on Belle Fourche, Wyo., and of 7 years on Santa Clara, Calif., indicate durability and efficiency of skeleton tetrahedrons of concrete for channel regulation and bank protection.

Washington. Report on Proposed Canals Connecting Puget-Sound–Grays Harbor, Grays Harbor–Willapa Bay, and Willapa Bay–Columbia River, submitted by Canal Commission of State of Washington, June 7, 1933. 160 pp., figs., diagrs., charts, tables. Technical report on construction of canal system to cost over $30,000,000; economic and commercial considerations; geology; locks and water supply for lockage; unit prices; tidal data.

IRRIGATION

Irrigation Canals, Silt. Colorado River Desilting at Imperial Dam. *Eng. News-Rec.*, vol. 115, no. 16, Oct. 17, 1935, pp. 538–541. Removal of 60,000 tons of silt per day by circular scrapers will save $1,000,000 annually in cleaning charges on All-American Canal: design based on extensive silt subsidence research and on model studies of various dam structures; operation of desilting basins; roller gates for flow control; novel design of influent channel.

LAND RECLAMATION AND DRAINAGE

Drainage. Problems in Fen Drainage, R. G. Clark. *Engineering*, vol. 140, no. 3636, Sept. 20, 1935, pp. 317–319. Consideration of fenlands problem as regards defense against water may be divided into two parts: their protection from inundation from either tidal rivers and upland floods and evacuation of water in their own area so as to avoid internal flooding. Before Brit. Assn.

Railroad Tracks. Drying Up Roadbed. *Ry. Age*, vol. 99, no. 19, Nov. 9, 1935, pp. 596–602. It is claimed that extensive program of major drainage operations carried out on the Pennsylvania Railroad, started in 1928, is paying large dividends in smoother, safer, and more economically maintained tracks.

MATERIALS TESTING

Cement, Strength. Behavior of High Early-Strength Cement, Concretes, and Mortars Under Various Temperature and Humidity Conditions, L. Schuman and E. A. Pisapia. *U. S. Bur. Standards—J. Research*, vol. 14, no. 6, June 1935 (RP799), pp. 723–747. 1 supp. plate. Data on properties of 12 commercial high-early-strength cements, and on various mortars and concretes made from them.

Road Materials. Los Angeles Abrasion Machine for Determining Quality of Coarse Aggregate, D. O. Woolf. *Pub. Roads*, vol. 16, no. 7, Sept. 1935, pp. 125–133. Description of Los Angeles abrasion test differing from standard Deval abrasion test in that test charge is caused to drop instead of to slide or roll, and also in that abrasive charge and sample composed of graded sizes of particles are used; test run of 500 revolutions is used instead of 10,000 revolutions; results obtained by two methods of testing compared.

PORTS AND MARITIME STRUCTURES

Breakwaters, Design. Vertical Wall Breakwaters, E. C. Cagli. *Engineer*, vol. 160, nos. 4157, 4158, and 4161, Sept. 13, 1935, pp. 272–274; Sept. 20, pp. 290–292; and Oct. 11, pp. 368–370; see also editorial comment, Sept. 13, p. 269. Sept. 13 and 20: Experience in Italy since 1926; failure of Catania Mole and of Mustapha jetty, Algiers; model experiments at Lausanne and wave observations at Genoa. Oct. 11: Reproduction in abridged form of translation of portions of reports by Bénézet and Renand, J. Lira, and A. de Rouville. Before 15th Int. Congress of Navigation, Brussels, 1935.

Seawalls, Concrete. Concrete Trestle-Type Quay at English Marine Terminal, E. E. R. Tratman. *Eng. News-Rec.*, vol. 115, no. 8, Aug. 22, 1935, pp. 265–267. 1,120-ft extension of Parkeston quay of London and Northeastern Railway, England, of precast concrete pile and concrete frame trestle, concreted in place; framing includes horizontal diagonal bracing and vertical bracing between bents; construction methods; transit shed and quay equipment; approach viaducts.

Suva, Fiji Islands. Port of Suva, Fiji; Its History and Development, A. A. Ragg, *Instn. Civ. Engrs.—Selected Eng. Papers*, no. 171, 1934, 24 pp., 1 supp. sheet. History and review of recent construction, including wharves; pile driving, slipway, lights, and beacons.

Wellington, N.Z. Wellington Harbour, N.Z., and Its Development, J. Marchbanks. *Instn. Civ. Engrs.—Selected Eng. Papers*, no. 143, 1933, 19 pp., 1 supp. sheet. History and description of harbor; dredging; seawalls; reclamations; wharves; cargo sheds; equipment of wharves and sheds; floating plant; slipways; repairs; cargo handling; trade of port; cost data on recent construction.

ROADS AND STREETS

Concrete. La construction des routes a revetement bétonné, J. Fedi. *Génie Civil*, vol. 106, no. 15, Apr. 13, 1935, pp. 357–360. Review of modern practice on design and construction of concrete highway with special reference to French experience.

Curves, Grade Change. Highway Vertical Curves, C. A. Hart. *Surveyor*, vol. 86, no. 2232, Nov. 2, 1934, pp. 423–424. Effect of rate of grade change on length of curve; effect of vision distance upon length of curve; types of vertical curves; calculation of simple parabolic vertical curves; vertical transition curves.

Curves, Speed. Speed in Relation to Curvature, with Special Reference to Road-Curves, F. G. Royal-Dawson. *Instn. Civ. Engrs.—Min. Proc.*, vol. 240, pt. 2, no. 4983, 1935, 33 pp. Nature of transition curves; speed values determined by standard rate of turning; working formulas; speed values of circular arcs; formulas for length of transition and superelevation; superelevating circular arcs; transition curve plotting instruments; suspended transitions; superelevation table for circular arcs on transition principles.

Highway Systems, National Parks, Mt. Rainier. Mt. Rainier National Park Highway System Developed Through Programmed Construction, J. Ewen. *Western Construction News*, vol. 9, no. 12, Dec. 1934, pp. 391–396. Development of plan for system of highways from Mt. Rainier National Park; review of progress.

Highway Systems, National Parks, Yellowstone. Red Lodge-Cooke Highway Nears Completion, G. E. Bjork. *Western Construction News*, vol. 9, no. 10, Oct. 1934, pp. 328–333. Construction of 69 miles of highway through rugged mountainous country in Yellowstone Park totaling over $2,000,000 in cost; method of operations; contractor's camp and personnel; surfacing and oiling.

Materials, Cotton. Cotton-Fabric-Reinforced Roads, W. K. Beckham and W. H. Mills. *Eng. News-Rec.*, vol. 115, no. 14, Oct. 3, 1935, pp. 453–455. Bituminous-surface treatments on both roads and bridge floors in South Carolina show superior durability when reinforced with cotton fabric; development work and results attained; cotton fabric reduces cracking, raveling, and failures.

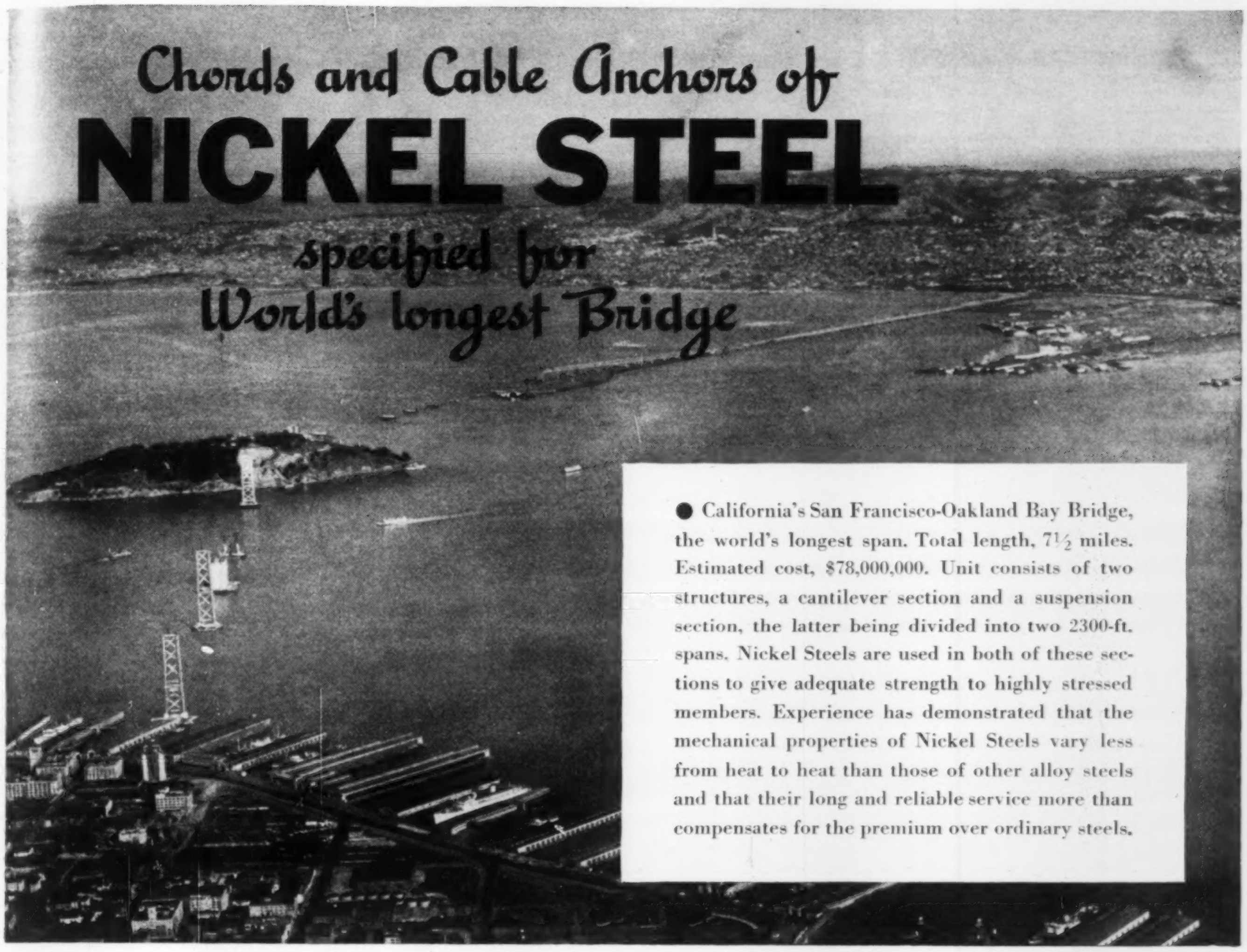
Materials, Iowa. Road and Concrete Materials of Southern Iowa, L. W. Wood. *Iowa Geol. Survey—Annual Reports*, vol. 36, 1935, pp. 8–310, 1 supp. sheet. Results of material resources survey covering all parts of state and all materials of interest; geology of road and concrete materials; descriptions of materials by counties; development of material deposits.

South Africa. Some Notes on Construction and Maintenance of Johannesburg Roads, E. Wills. *S. African Instn. Engrs.—J.*, vol. 33, nos. 8, 10, and 11 and vol. 34, no. 2, Mar. 1935, pp. 158–164 (discussion), 164–167 (discussion), May, pp. 224–226; and Sept. pp. 33–35. Macadam roads; two-course asphalt surface on concrete, hand-packed, or existing macadam base; penetration or grouting macadam; veneer asphalt carpet; street maintenance; surface dressing.

SEWERAGE AND SEWAGE DISPOSAL

New York City. Treating Coney Island's Sewage. *Eng. News-Rec.*, vol. 115, no. 15, Oct. 10, 1935, pp. 489–493. Design and construction of new 35-mgd sludge-gas-operated plant in greater New York City; plain sedimentation augmented by chemical precipitation and chlorination during summer months; effluent discharged $1^1/_2$ miles from shore; sedimentation tank details; sludge pumping and tank control equipment; submerged distribution chamber of outfall; power plant.

Odor Control. Elimination of Odors at Sewage Treatment Plants. *Mun. Sanitation*, vol. 5, no. 8, Aug. 1934, pp. 277–279. Practical discussion of occurrence and control of odors in sewage disposal plants in United States.



Chords and Cable Anchors of
NICKEL STEEL
specified for
World's longest Bridge

● California's San Francisco-Oakland Bay Bridge, the world's longest span. Total length, 7½ miles. Estimated cost, $78,000,000. Unit consists of two structures, a cantilever section and a suspension section, the latter being divided into two 2300-ft. spans. Nickel Steels are used in both of these sections to give adequate strength to highly stressed members. Experience has demonstrated that the mechanical properties of Nickel Steels vary less from heat to heat than those of other alloy steels and that their long and reliable service more than compensates for the premium over ordinary steels.

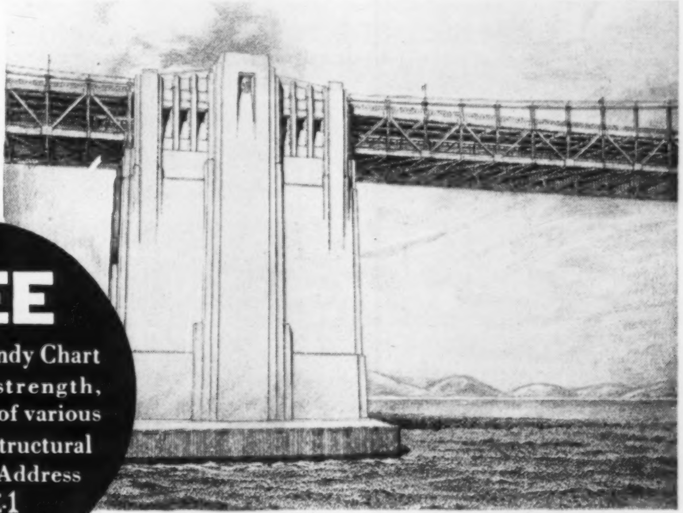
● Cantilever section (at right above) is most severely stressed in the upper and lower chords near main piers. For these highly stressed members 3400 tons of Nickel Steels were specified to show minimum properties in the as-rolled condition as follows:

Tensile Strength	90,000 lbs. p. s. i.
Yield Point	55,000 " "
Elongation (%)	1,600,000 over T. S.
Reduction of Area	30%

Bend Test: 180 around a diameter 1½ times thickness of plate.

• • •

● Pictured at right is the central anchorage in west channel which takes the live load pull of the two 2300-foot suspension cables. Upper portion of this structure will contain 280 tons of 23′0″ by 34′6″ Nickel Steel anchor plates to which cable ends will be attached. Because of superior strength and toughness and high resistance to fatigue, Nickel Steel was assigned this all-important role. • Our staff of engineers is always ready to cooperate with you in recommending suitable compositions and applications of Nickel Alloy Steels.



FREE
Send for our Handy Chart giving tensile strength, yield point, etc., of various Nickel Steel structural compositions. Address Dept. CE-1

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.

Plants, Design. Recent Sewage Plant Developments Call for Fresh Approach to Design Problems, S. A. Greeley. *Eng. News-Rec.*, vol. 115, no. 15, Oct. 10, 1935, pp. 501–502. Review of recent progress; round tanks now possible; gas used for power; sludge dewatering; chemical treatment efficiency; wide treatment range possible.

Plants, Equipment. Mechanical Equipment in Sewage Treatment, C. C. Agar. *Sewage Works J.*, vol. 7, no. 1, Jan. 1935, pp. 56–59. Review of use of equipment in New York State sewage disposal plants. Before New England Sewage Works Assn.

Plants, Incinerators. Incineration of Sewage Solids, A. E. Stilson. *Sewage Works J.*, vol. 7, no. 1, Jan. 1935, pp. 60–66, (discussion) 66–69. Review of equipment and methods; approximate values of various waste substances; ignition temperatures of various substances. Before New York State Sewage Works Assn.

Pumping Plants, Great Britain. Sewage Pumping Practice in Great Britain, F. J. Taylor. *Mun. Sanitation*, vol. 5, no. 10, Oct. 1934, pp. 342–343. Review of recent British practice, with special reference to the selection and arrangement of sewage pumps.

San Francisco. Report on Treatment and Disposal of Sewage of City and County of San Francisco, Calif., to W. H. Worden by Board of Consulting Sanitary Engineers. Mimeographed copy, 85 pp., May 1935, figs., diagrs., charts, tables on supp. sheets. Study of structures and methods of sewage disposal with view of preventing pollution of beaches and coastal waters; climatology, tides, and currents; existing and proposed sewerage districts and systems; construction cost estimates; estimated cost of operation as of 1940; recommendations.

Sewers, Gas Hazards. Gas Hazards in Sewers and Plants, R. R. Sayers. *Mun. Sanitation*, vol. 5, no. 8, Aug. 1934, pp. 262–266. Poisonous and explosive gases found in manholes; properties of gases and prevention of poisoning by gases found in sewers and treatment plants; treatment of poisoning. Bibliography. Before Ill. Soc. Engrs.

Sludge Drying. Spray Drying of Sludge, J. R. Downes. *Wate Works & Sewerage*, vol. 82, no. 9, Sept. 1935, pp. 323–325. Description of full-sized plant unit installed at Plainfield, North Plainfield, and Dunellen (N.J.) joint sewage works drying all digested sludge from sewage contributed by 50,000 persons; principle of process; results and costs of operation; disposal of product; disposal of supernatant liquid from digestors; odor control.

Sludge, Experiments. Digestion of Mixtures of Sludge from Domestic Sewage and Packing-House Wastes, O. J. Knechtges, F. M. Dawson, and M. S. Nichols. *Sewage Works J.*, vol. 7, no. 1, Jan. 1935, pp. 3–16. Report on experimental study made at University of Wisconsin using Madison sludges, leading to conclusion that admixture of packing-house and domestic sewage sludges in no way hinders digestion of either sludge.

Sludge, Illinois. Separate Sludge Digestion Tanks and Their Operation, W. B. Walraven. *Sewage Works J.*, vol. 7, no. 1, Jan. 1935, pp. 70–81. Practice of Sanitary District of Springfield, Ill.; facilities at Springfield; starting digestion tanks; sludge temperature; proportion of raw and digesting solids; coefficient of heat transfer; heat loss from tanks; foaming; formation of scum; stage digestion; analytical data; drying on sand beds; gas power development; digestion versus filtration. Before Eighth Ohio Conference on Sewage Treatment.

Stream Pollution, Great Britain. Report of Water Pollution Research Board for Year Ended 30th June, 1934, with Report of Director of Water Pollution Research. (Great Britain.) *Dept. Sci. & Indus. Research—Report*, 1934, 44 pp. Price 9d net. Research on: Base-exchange or zeolite water softening; contamination of water by lead; milk-factory effluents; oxidation of fats and soaps; bio-chemical oxygen demand; activated sludge process; oxidation of sewage, ammonia, and other substances; colloids in sewage; gas-works effluents; River Mersey investigation.

Stream Pollution, Petroleum Waste. Oil Pollution and Refinery Wastes, H. F. Ferguson. *Sewage Works J.*, vol. 7, no. 1, Jan. 1935, pp. 104–115. Report of Committee on Oil Pollution, Conference of State Sanitary Engineers, Oct. 1934; extent of oil production and refineries and waste pollution; effects of oil field waste pollution; abatement methods; refinery wastes; increased chlorine demand of public water supplies due to refinery wastes; tastes and odors in public water supplies due to refinery wastes. Bibliography.

Tanks. Foaming in Sedimentation Tanks. *Mun. Sanitation*, vol. 5, no. 9, Sept. 1934, pp. 310–313, and 316. Practical discussion of causes and method of control of foaming in sedimentation tanks.

STRUCTURAL ENGINEERING

Beams, Concrete. Flexural Resistance of Shallow Concrete Beams, C. B. McCullough. *Eng. News-Rec.*, vol. 115, no. 12, Sept. 19, 1935, pp. 406–407. Results of tests by Oregon Highway Department indicating large increase in load-carrying capacity from increased steel percentage; tests indicate justification of working stresses much higher than present standards; effect on flexural resistance of various types of web reinforcement; comparison of actual breaking loads with theoretical safe loads for varying unit stresses.

Research, United States. Current Studies at Iowa State College, W. J. Schlick. *Eng. News-Rec.*, vol. 115, no. 16, Oct. 17, 1935, pp. 542–545. Review of original research on underground conduits, highway transportation, structural engineering, engineering materials, sanitary engineering, soil-erosion control, and engineering valuation.

Stresses. Potential Function Method for Solution of Two-Dimensional Stress Problems, C. W. MacGregor. *Am. Mathematical Soc.—Trans.*, vol. 38, no. 1, July 1935, pp. 177–186. Outline and applications of potential method; general expressions for stresses in terms of potential functions or functions of complex variable; general expressions for displacements in terms of potential functions; application of method to special problems in semi-plane.

TUNNELS

Aqueducts, Colorado River. Watertight Pump Chambers for Flooding Tunnel. *Eng. News-Rec.*, vol. 115, no. 8, Aug. 22, 1935, pp. 252–255. Method of controlling inflow as high as 4,000 gal per min in construction of San Jacinto tunnel, 13 miles long, for Colorado River aqueduct or southern California, by means of sealed pump chambers located at shaft bottoms and operated from shaft tops; access doors; connections between pump chamber and shaft; equipment included 7-main pump units, five with capacity of 2,600 gal per min and two with capacity of 1,000 gal per min.

Reservoirs, Outlet. Tunnel-Canal-Siphon Outlet of Casper-Alcova Reservoir. *Eng. News-Rec.*, vol. 115, no. 12, Sept. 19, 1935, pp. 385–388. Design and construction of reservoir-outlet works of irrigation system in Wyoming, consisting of two tunnels through parallel ridges, intervening canal section with one siphon, and siphon beyond second tunnel leading into main canal system, totaling 3.6 miles in length.

Vehicular, California. Wawona Highway Tunnel Eliminates Inspiration Point Grade, C. G. Thomson. *Western Construction News*, vol. 9, no. 8, Aug. 1934, pp. 264–265. Construction of Yosemite Valley (California) vehicular tunnel 4,230 ft long on tangent (5 per cent grade), with width of 28 ft and height of 19 ft, concrete-paved throughout; ventilating setup; automatic carbon-monoxide recorders.

Vehicular, Specifications. Midtown Hudson Tunnel. New Jersey Land Sections and Plaza. *Port of N.Y. Authority—Contract MHT-5*, Nov. 1935, 341 pp. Specifications for contract MHT-5 for construction of New Jersey land sections and plaza of midtown Hudson tunnel, New York.

Water Supply, Construction. High-Speed Tunnel Driving in Soft Material at Pasadena. *Eng. News-Rec.*, vol. 115, no. 15, Oct. 10, 1935, pp. 513–514. Method of driving 12,000-ft water-supply tunnel for Pasadena, Calif., 13 ft in diameter; heading advance through sand and gravel exceeds 2,000 ft per month.

WATER PIPE LINES

Chlorination. Chlorination of 48-In. Pipe Line, New Bedford, Mass., E. J. Sullivan. *New England Water Works Assn.—J.*, vol. 49, no. 2, June 1935, pp. 221–224. Chlorination of new concrete pipe line before beginning operation; effect of chlorination of pipe line on bacterial content of water.

Cross-Connections. Status of Cross-Connection Regulations, C. W. Mowry. *New England Water Works Assn.—J.*, vol. 49, no. 1, Mar. 1935, pp. 66–71. Summary of policies of state health authorities; policy of U. S. Public Health Service; enforcement of regulations; conference of State Sanitary Engineers; report of American Water Works Assn.; performance of protective devices; double check valves; fire-pump chlorinators; interior building piping and plumbing fixtures; New York State survey; Chicago amoebic dysentery outbreak.

WATER TREATMENT

Filtration, Materials. Study of Filtering Materials for Rapid Sand Filters—VI, J. R. Baylis. *Water Works & Sewerage*, vol. 82, no. 9, Sept. 1935, pp. 326–330. Mud ball formation and measurement; effect of kind of filtering material upon mud ball formation; condition of filter beds when surface washes were not used; measuring volume of mud balls in filters; use of layer of coarse material on top of fine material of greater specific gravity; water required for surface washing filters; effect of porosity on clogging rate; corrections.

Filtration Plants, Equipment. Sand Rise Indicator. *Water Works & Sewerage*, vol. 82, no. 9, Sept. 1935, p. 333. Description of easily made, serviceable instrument for measuring sand levels in filters to determine expansion when washing, devised and built by C. F. Bingham and R. T. Homewood.

Plants, Lake Michigan. Design of Water Purification Plants at South End of Lake Michigan, P. Hansen. *Am. Water Works Assn.—J.*, vol. 27, no. 6, June 1935, pp. 692–702. Progress in water purification since preparation of reports of U. S. Public Health Service; experience with several water supplies at south end of Lake Michigan; status of sewage disposal.

Plants, Silt Control. World's Largest Water Treatment Plant Will Desilt Colorado River Water. *Water Works & Sewerage*, vol. 82, no. 9, Sept. 1935, p. 316. 50,000 tons of silt to be removed daily from 8,000,000,000 gal of water in U. S. Bureau of Reclamation plant to be built near Yuma, Ariz., at cost of $38,500,000.

Protozoa. Synura Troubles at Albany, New York, G. E. Willcomb. *Am. Water Works Assn.—J.*, vol. 27, no. 6, June 1935, pp. 742–748. Methods of combating sudden appearance of synura under ice of Alcove Reservoir, by copper treatment, aeration, application of activated carbon, and prechlorination; experience in Albany indicates that carbon treatment alone is more economical remedial measure.

WATER WORKS ENGINEERING

Aberdeen, S.C. Aberdeen Abandons Wells for Treated Surface Supply, W. W. Matthews. *Eng. News-Rec.*, vol. 115, no. 11, Sept. 12, 1935, pp. 361–365. After 50 years of dependence on highly mineralized deep-well facilities rapidly diminishing in quantity, impounded surface supply was developed; storage and diversion dams and 4-mgd treatment plant built with PWA funds; Willow Creek Dam construction; Elm River diversion dams; softening and filter plant.

Laws and Legislation. Legal Aspects of Large Artificial Lake Water Supply Project, C. J. Barber. *Am. Water Works Assn.—J.*, vol. 27, no. 6, June 1935, pp. 755–760. Review of Illinois laws as to raising of funds, acquisition of land, and protection of shore line.

Operation. Thirteen-Year Record of Operation of Municipal Water Department, L. R. Burch. *Water Works & Sewerage*, vol. 82, no. 7, July 1935, pp. 233–236. Operating record of City Water Department of Tucson, Ariz.; number of consumers; office expense; pipe-line maintenance; pumping costs; total operating costs; yearly improvements; total budgeted expenditures; bond interest and retirement fund; total costs and receipts; effect of metering; water rates and revenues.

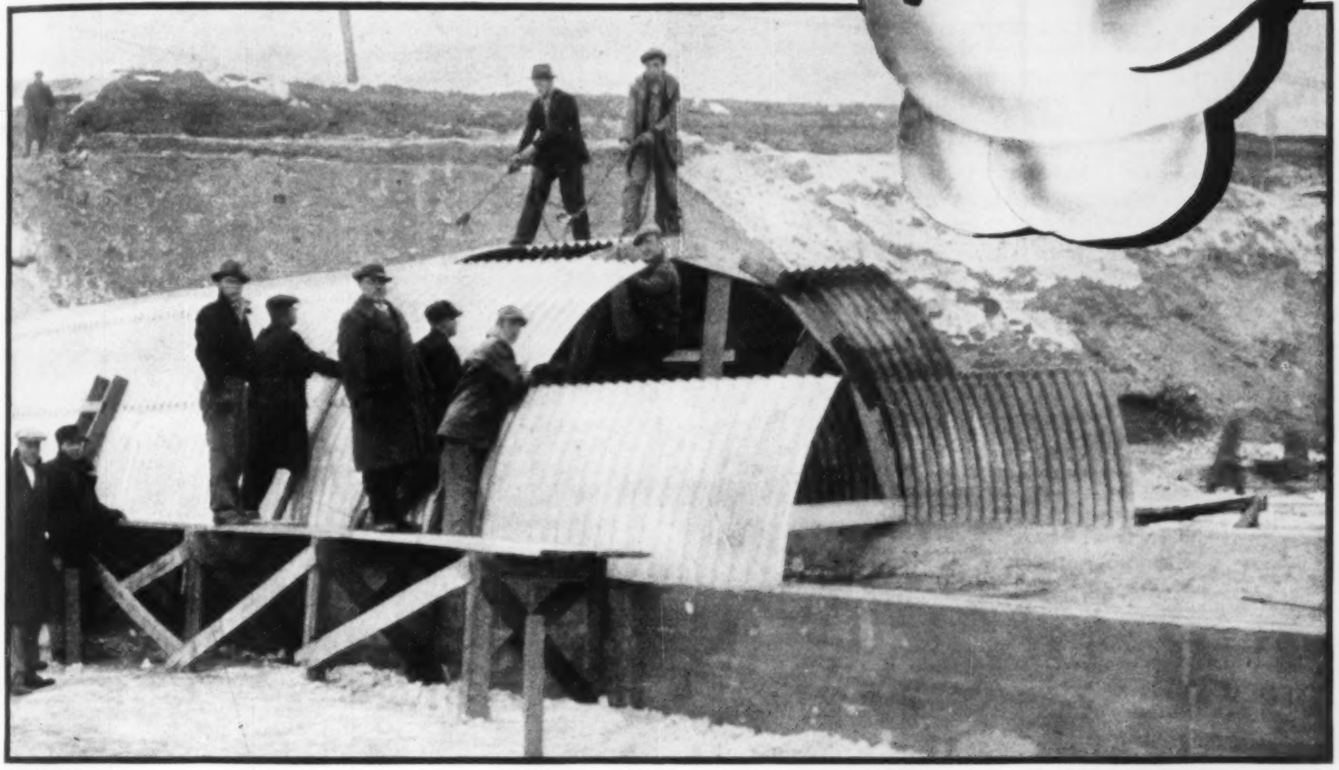
Tanks, Paint. Recent Taste and Odor Tests of Paints for Water Tanks, G. L. Hall. *Eng. News-Rec.*, vol. 115, no. 19, Nov. 7, 1935, p. 639. Tests by Maryland State Department of Health, Baltimore, on ten types of paint for interior of water tanks to determine which of them would not impart tastes or odors to water stored therein.

United States. Meeting of Maryland-Delaware Water and Sewerage Association. *Water Works & Sewerage*, vol. 82, no. 6, June 1935, pp. 219–221. Proceedings, including abstracts of papers and discussions: Comprehensive Plans for Water Supply and Sewerage in Maryland, J. R. McComas; High Cost of Algae, G. E. Harrington; Design of Moore's Run Inverted Syphon, F. H. Fivored; etc.

Wells. Developing Well Water Sources at Tacoma, Wash. *Eng. News-Rec.*, vol. 115, no. 15, Oct. 10, 1935, pp. 514–515. Method of driving large-capacity wells to supplement gravity water supply; delivery of 9 mgd from one well with maximum drawdown of 60 ft is typical supply capacity; driving and perforating casings.

Wells, Iowa. Deep Wells Drilled in Iowa, 1928–1932, W. H. Norton. *Iowa Geol. Survey—Annual Reports*, vol. 36, 1935, pp. 311–364. General character of underground water geology of Iowa; data on deep city and farm wells.

Who's Afraid of the BIG BAD SNOWMAN



Installing a Multi Plate Arch to extend an existing storm drain in a large northern city. The arch was erected on concrete footings and floor provided with vitreous enamel liner plates. Winter weather failed to halt the work.

DURING recent years municipal engineers have learned by experience that "shutting down for the winter" is not necessary. In fact, there are sound reasons for keeping many kinds of work going on during the winter.

Necessary sewers can be built and ready to carry the peak loads of spring and early summer. Small bridges and culverts built now will enable the backfill to compact during the months of maximum ground moisture. And even more important, winter work provides employment when labor really needs a job.

So put in your sewers, culverts and small bridges this winter. By using Armco Corrugated pipe and Multi Plate, you can expect completed jobs of *known quality*—even under the most severe working conditions. And remember, too, that Armco engineers are always at your service.

ARMCO CULVERT MANUFACTURERS ASSN.
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Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

Link-Belt Circular Tank Sludge Collector Announced

ANNOUNCEMENT is made by Link-Belt Company, Philadelphia, of the development of a new sludge collector, to be known as the Link-Belt Circuline sludge collector; for use in circular centrally fed settling tanks.

The machine consists of a motor propelled, centrally pivoted, structural steel bridge carrying the sludge collecting medium, being driven positively at the circumference. The collecting medium is essentially a Link-Belt Straightline collector employing two strands of Promal chain connected with scraper flights at suitable intervals, as has been used in rectangular tanks for many years for handling sludge and industrial wastes.

The squeegee on the sludge plate of the Circuline collector comes in direct contact with the floor, collecting practically all of the settled sludge and immediately and positively conveying it to the sludge collecting hopper. This positive method of sludge removal is said to assure a maximum sludge density.

Scum which floats on the surface of primary settling tanks is collected by scum plate and conveyed by top run of collecting medium to the periphery of tank. The scum plate near the periphery of tank is hinged so that it will automatically deposit the collected scum in the scum trough.

National Paving Brick Association Meeting

THE Thirtieth Annual Meeting of the National Paving Brick Association will be held at Columbus, Ohio, January 29, 30, and 31, 1936, at the Deshler-Wallick Hotel.

The program, now under preparation, will consist of papers and discussions by prominent engineer and contractor users of paving brick, recent important developments in paving brick production and utilization, and descriptions of modern brick street and highway paving and resurfacing projects. The Research Bureau maintained by the National Paving Brick Association at the Ohio State University Experiment Station will present a résumé of its work and an inspection trip will be scheduled to the experimental road recently completed in Hocking County on Ohio Route 31 near Columbus. On this State and Federal Project eighteen different kinds of fillers, developed in the laboratory of the Research Bureau, have been installed.

Mr. George F. Schlesinger, Chief Engineer and Secretary of the association, states that most of the sessions will be open to the general public.

New "Caterpillar" Models

THE Caterpillar Tractor Co. of Peoria, Illinois, announces four new Diesel tractors, to be known as the RD-8, RD-7, RD-6, and RD-4, and a spark ignition machine called the Thirty.

The first three Diesel models succeed the Diesel Seventy-Five, Diesel Fifty, and Diesel Forty and are comparable with them in everything except power. Engines in these three incorporate all the features of the former models and achieve greatly increased power through an increase in cylinder bore and other refinements that have been made in the engine and fuel injection system.

This new RD line of tractors, according to the announcement of the manufacturer, will increase production and decrease net costs in construction and earth-moving tasks. The comparison test reported is: a Diesel Seventy-Five pulling a 12-yard scraper on a 650-ft haul made round trips in 5.38 minutes, moving 55.8 cu yd of earth per hour, and at a cost of 7.8 cents per yd. An RD-8 on the same job made round trips in 3.93 minutes, moving 76.2 cu yd per hr at a cost of 5.8 cents per cu yd. The latter, over a number of 8-hr work periods, showed a production increase of 36.5 per cent over the Diesel Seventy-Five. Increase in fuel cost was negligible.

Except for addition of the new Thirty, no change in the company's line of gasoline tractors is announced. Present models are the Twenty-Two, Twenty-Eight, Forty, Fifty, and Seventy tractors.

A New Cable Highway Guard

A CATALOG of 42 pages, describing the Multisafty Cable Highway Guard has been issued recently by the American Steel & Wire Company. The suitability of wire cable for highway guards, a description of the construction advantages, the cost of installation, general specifications with detailed drawings showing construction, including special post off-set spring, the cost of maintenance, appearance, and proving ground tests are the subjects treated in this catalog.

A New Joint Compound

THE Atlas Mineral Products Company, Mertztown, Pa., reports success in the application of the new product termed "Tegul Mineralead" in the jointing of water mains. According to the announcement four hundred feet of 8-in. pipe were lately joined in Virginia which showed absolutely no initial leakage under 115 lb sq in. pressure. Two thousand two hundred ft of 6-in. pipe were joined in Ohio on which installation only 4 joints in the entire line dripped.

Inland Announces Hi-Steel

THE Inland Steel Company, Chicago, has announced a new steel—Hi-Steel. It is said to be of the so-called low alloy, high tensile strength class, and its characteristics promise that it will prove to be one of the best steels of this group. The minimum yield point is 60,000 lb per sq in. for gages lighter than $^{1}/_{4}$-in. and 55,000 lb in heavy gages. Minimum ultimate tensile strength is 70,000 lb per sq in. giving it a high elastic ratio. The elements used give this alloy a high degree of uniformity and physical characteristics as well as workability. Tests extending over a year's time show that it will bend, form, stamp, seam, and weld readily. It is highly resistant to corrosion, promising many times the life of ordinary grades of steel. It will be supplied as sheets, strip, plates, bars, and structurals.

A New 30-Yard Excavator

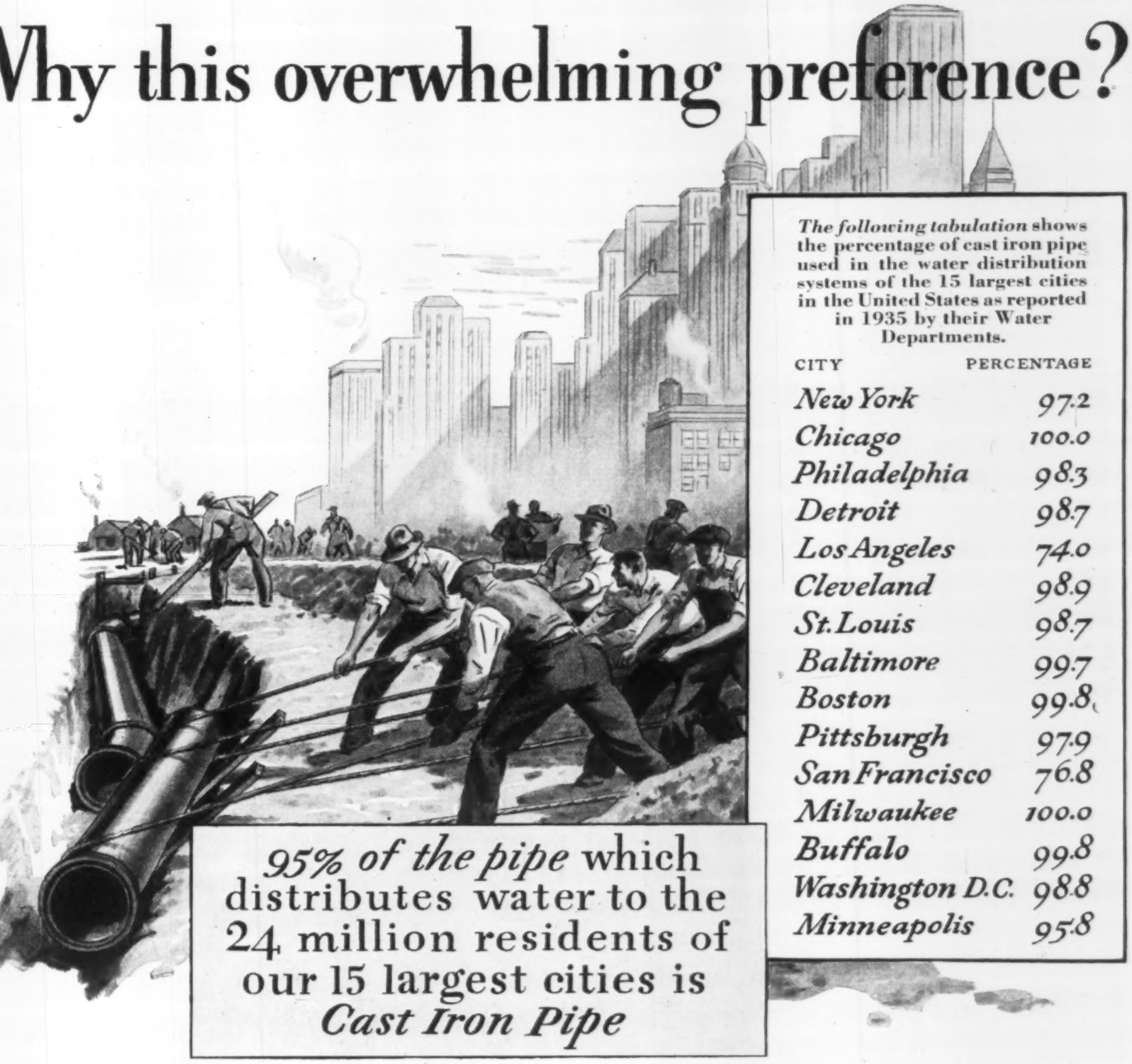
THE FIRST of the new giant Bucyrus-Erie 950-B power shovels has recently been put into service by the Binkley Coal Company of Indiana on its coal stripping operations near Terre Haute. This machine has a boom 105 ft long, a dipper stick 64 ft long, a maximum dumping height of 70 ft, a cutting radius of 115 ft, and a dumping radius of 106 ft. Thirty-two different electric motors are used in the various operations of moving, leveling, digging, and dumping. These motors range in size from $^{1}/_{8}$ H.P. to one of 1000 H.P. which drives four main generators. The manufacturer reports that in operation, the huge 30-yd dipper of this shovel lifts 45 tons of dirt and rock.

Lincoln Announces New Electrode for Welding 25-12 Stainless Steels

A NEW arc welding electrode for welding the group of stainless steels belonging to the 25-12 variety is announced by The Lincoln Electric Company, Cleveland, Ohio. It is described as a new coated electrode, known as "Stainweld B," which provides weld metal of the same high corrosion-resistance, high tensile strength and ductility as steel containing 25 per cent chromium and 12 per cent nickel. Tensile strength tests show that "Stainweld B" weld metal resists a stress of 95,000 lb per sq in. Because of its higher chrome content the new electrode is particularly advantageous for welding stainless clad steels.

"Stainweld B" electrode, together with the well known Lincoln "Stainweld A" for 18-8 stainless steels, now makes it possible to arc weld practically any of the more extensively used stainless alloys.

Why this overwhelming preference?



The following tabulation shows the percentage of cast iron pipe used in the water distribution systems of the 15 largest cities in the United States as reported in 1935 by their Water Departments.

CITY	PERCENTAGE
New York	97.2
Chicago	100.0
Philadelphia	98.3
Detroit	98.7
Los Angeles	74.0
Cleveland	98.9
St. Louis	98.7
Baltimore	99.7
Boston	99.8
Pittsburgh	97.9
San Francisco	76.8
Milwaukee	100.0
Buffalo	99.8
Washington D.C.	98.8
Minneapolis	95.8

95% of the pipe which distributes water to the 24 million residents of our 15 largest cities is *Cast Iron Pipe*

THE great majority of American cities depend almost exclusively on cast iron pipe for water distribution mains because of its unquestioned economy and long life. With modern traffic conditions and high-cost pavements a pipe line must go down to stay. Engineers rate the useful life of cast iron pipe at 100 years. Its full span of service is yet to be measured. Suffice it to say that the first recorded installation of a cast iron water main, now 271 years old, is still in service.

Cast iron pipe is the standard material for water mains. Its useful life is *more than a century* because of its effective resistance to rust. It is the one ferrous metal pipe for water and gas mains, and for sewer construction, that will not disintegrate from rust.

For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Ill.

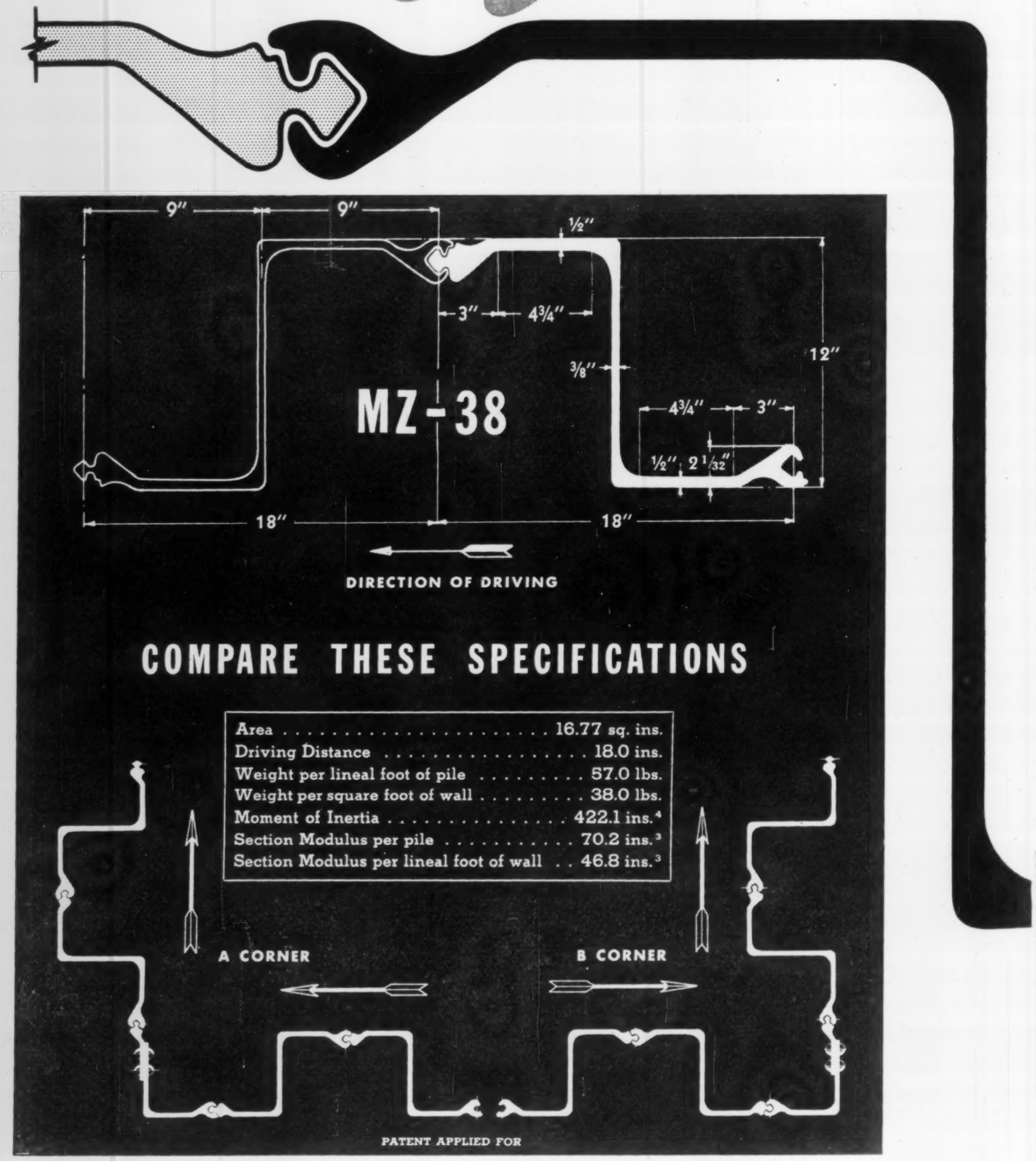
CAST IRON PIPE

METHODS OF EVALUATING BIDS NOW IN USE BY ENGINEERS RATE THE USEFUL LIFE OF CAST IRON PIPE AT 100 YEARS

TRADEMARK REG.

Offering

"HIGHEST BEAM STRENGTH COMPARED TO WEIGHT"


9"
9"
½"
3"
4¾"
12"
⅜"
MZ-38
4¾"
3"
½"
2 1/32"
18"
18"
DIRECTION OF DRIVING
A CORNER
B CORNER
PATENT APPLIED FOR

COMPARE THESE SPECIFICATIONS

Area	16.77 sq. ins.
Driving Distance	18.0 ins.
Weight per lineal foot of pile	57.0 lbs.
Weight per square foot of wall	38.0 lbs.
Moment of Inertia	422.1 ins.^{4}
Section Modulus per pile	70.2 ins.^{3}
Section Modulus per lineal foot of wall	46.8 ins.^{3}

CARNEGIE-ILLINOIS "Z" PILING

A new, more economical construction for long spans and heavy lateral loads

IN introducing MZ-38—the first "Z" Piling to be rolled in this country—Carnegie-Illinois Steel Corporation offers you a Steel Sheet Piling having the highest beam strength for its weight developed to date. This new improved Piling section is *two-and-a-half times as efficient* as any sections produced in America—and is considerably more efficient than "Z" sections produced elsewhere.

Consider these figures:—MZ-38 has section modulus per lineal foot of wall of 46.8 inches—yet weighs only 38 pounds per square foot of wall—57 pounds per lineal foot of pile. The reasons are obvious why MZ-38 will assure particularly economical construction for wharves, piers, bulkheads, docks, sea-walls, canal locks and similar structures retaining heavy lateral loads over long spans.

A sixteen-page addition to our Piling Catalog fully describing these new "Z" Piling sections, is now in the mails. Be sure you get a copy. Our engineers are always ready to cooperate with you and will gladly furnish any additional information you may require.

NEW DESIGN INTERLOCK FACILITATES DRIVING, INSURES WATER TIGHTNESS, PRESERVES ALIGNMENT

The advantages of the ball-and-socket interlock, its easy driving, freedom from soil packing, ability to drive deep without spreading, have been amply demonstrated.

In this *improved* design, a triangular shaped ball with metal balanced both on ball and socket ends introduces a double locking feature which gives maximum water tightness, reduces tendency of piling to creep and twist in driving, minimizes swing in the interlock and permanently preserves piling alignment.

In addition, the concentration of metal in the triangular-shaped ball greatly reinforces this ball against curling during hard driving and facilitates the use of long sections in hard bottoms.

INTERLOCK LOCATION MAKES WELDING UNNECESSARY

Note that in this "Z" pile, interlocks are located where longitudinal shear is zero—the section modulus of the single uninterlocked pile is thus the same as when interlocked. No welding of interlocks is necessary to prevent slippage due to longitudinal shear, in order to obtain the interlocked section modulus.

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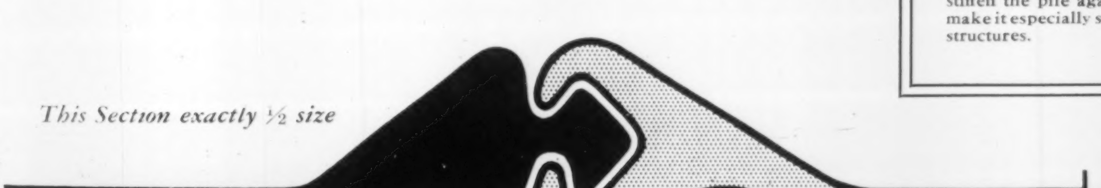
Examine this "Z" section closely and you will see that ruggedness has not been sacrificed for light weight. Ample thicknesses of metal at the proper points assure that the strength of the pile will not be prematurely impaired by corrosion. Note the heavy concentrations of metal at the four exposed points. They stiffen the pile against heavy battering, make it especially suitable for deep water structures.



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Miscellaneous

Draftsman, Surveyor; Jun. Am. Soc. C.E.; 29; married; 3 years Rensselaer Polytechnic Institute; 1 year New York University; 3 years structural steel detailing on bridges and other railroad structures; 15 months surveying and construction work in field; 6 months plant layout, equipment, heating; 15 months estimating, computing. References. Available immediately. D-4295.

Research

Engineer, Research Work; Jun. Am. Soc. C.E.; 30; married; B.S. M.A., Colorado State College; 5 years experience with the U. S. Bureau of Reclamation in designing, construction, and testing of hydraulic models; computation, compilation of data, and preparation of reports. Responsible charge of laboratory; desirous of making connection with chance for advancement. D-4426.

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RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1935. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

Drafting for Engineers. By C. L. Svensen. 2 ed. New York, D. Van Nostrand Co., 1935. 554 pp., illus., diagrs., charts, tables, 10 × 6 in., cloth, $3.

This text provides a comprehensive course of instruction, based on present industrial and professional standards and covering the entire field of engineering drawing. In addition to covering the fundamental principles, the work contains chapters on such special subjects as structural, electrical, and topographic drafting, graphic charts, and technical illustrations. The number of chapters in this edition has been increased from nineteen to thirty, and the book is one-half longer than before. Over fifteen hundred problems are provided.

Eidgenössische Materialprüfungsanstalt an der E. T. H. Zürich (Laboratoire Fédéral d'Essais des Matériaux Annexé à l'École Polytechnique Fédérale a Zürich). Bericht Nr. 86. Festigkeit Geschweisster Verbindungen, by M. Ros and A. Eichinger. Zürich, Switzerland, 1935. 28 pp., illus., diagrs., charts, tables, 12 × 9 in., paper, apply.

This report discusses the fatigue tests of welds carried out since 1927 at the Federal Materials Testing Laboratory, Zürich. Upon the basis of test results, two methods are deduced—one precise and the other approximate—for computing the strength and deformation properties to be expected from a weld.

Eidg. Materialprüfungsanstalt an der E.T.H. in Zürich (Laboratoire fédéral d'Essai des Matériaux annexé à École Polytechnique Fédérale a Zürich). Bericht Nr. 89. Die Knickung der Eisenbeton-Säulen, by O. Baumann. Zürich, Switzerland, December 1934. 56 pp., illus., diagrs., charts, tables, 12 × 8 in., paper, apply.

A report upon theoretical and experimental investigations of the buckling of reinforced concrete columns, especially under eccentric loads. A method of determining the buckling resistance of beams is derived.

Great Britain. Department of Scientific and Industrial Research. Report of the Road Research Board for the Period Ended March 31, 1935. London, His Majesty's Stationery Office, 1935. 133 pp., illus., diagrs., charts, tables, 10 × 6 in., paper, 3s. 0d.

This report describes the work of the British Road Research Laboratory during the past two years. The investigations included a study of skidding, aiming at the determination of the factors in vehicle design which induce it, and the factors in road conditions which favor it. Progress in the development of road testing machines is also reported. The greater part of the report deals with investigations of road materials and processes of road construction. The results obtained are discussed in detail.

Mitteilungen aus dem Institut für Baustatik an der Eidg. Technischen Hochschule in Zürich. Mitteilung Nr. 5. Die Spundwand als Erddruckproblem, das Spundwandproblem mit Berücksichtigung der Erddeformation und der Wandelastizität. By I. Rifaat. Zürich and Leipzig, Verlag Gebrüder Leemann & Co., 1935. 87 pp., illus., diagrs., charts, tables, 9 × 6 in., paper, 3 Swiss francs.

This pamphlet presents the results of a careful mathematical and experimental study of the forces acting upon sheet piling, carried out at the Earth Pressure laboratory of Zurich Technical High School. The effects of earth pressure and wall elasticity upon the distribution of the stresses affecting the stability of sheet piling were studied, and practical conclusions drawn.

Mitteilungen des Forschungsinstituts für Maschinenwesen beim Baubetrieb. Edited by G. Garbotz. Heft 8. Erwärmungs- und Trocknungsvorgänge in Gesteinstrockentrommeln beim Gegen- und Gleichstromverfahren. By G. Stiller. Berlin, VDI-Verlag, 1935. 26 pp., illus., diagrs., charts, tables, 12 × 8 in., paper, 9 rm.

This report presents the results of an extensive study of the action of rotary driers for drying stone for road construction. The conclusions will be useful in other connections, as well as to the builder of tar-macadam and asphalt roads.

Great Britain, Department of Scientific and Industrial Research. Building Research Bulletin No. 6. The Prevention of Corrosion of Lead in Buildings. By F. L. Brady. 2 ed. London, His Majesty's Stationery Office, 1935. 4 pp., illus., 10 × 6 in., paper, 3 d. (Obtainable from the British Library of Information, 10 cents.)

The corrosion of lead by lime, cement, and soil, and the methods of prevention are discussed very briefly in this pamphlet, which is a summary of a more detailed publication by the Building Research Board.

Regeln für die Durchflussmessung mit Genormten Düsen und Blenden, VDI-Durchflussmesserregeln. DIN 1952. 3 ed. Berlin, VDI-Verlag, 1935. 22 pp., diagrs., charts, tables, 12 × 8 in., paper, 5 rm.

This pamphlet presents the revised rules of the German Standards Association for measurement of the flow of fluids by standard nozzles and diaphragms. Accompanying the rules are a discussion of the theoretical principles involved and additional information on the use of the rules, together with some examples.

Resistance of Piles to Penetration, together with Tables of Approximate Values Based on the Hiley Formula, with a Foreword by Sir Cyril Kirkpatrick. By R. V. Allin. London, E. & F. N. Spon; New York, Engineers Book Shop (168 East 46th Street), 1935. 130 pp., diagrs., charts, tables, 9 × 6 in., cloth, 10s. 6d.

This book is essentially a collection of tables and graphs intended to facilitate the driving of timber and precast concrete piles. The tables are based on the Hiley formula, for which close agreement with actual loading tests is claimed.

Road Aggregates, Their Uses and Testing. (Roadmakers' Library, Vol. 3.) By B. H. Knight. London, Edward Arnold & Co.; New York, Longmans, Green & Co., 1935. 264 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $8.

This book applies the knowledge obtained by the scientific study of road aggregates to the practical problems encountered by the road engineer. It describes the structure and physical properties of rocks, slags, clinkers, sands, and gravels, the making of physical tests, and the sieving and elutriation of aggregates for concrete. The book appears to be the first devoted solely to the testing and uses of road aggregates.

The Story of Telford, the Rise of Civil Engineering. By A. Gibb. London, A. Maclehose & Co., 1935. 358 pp., illus., map, 9 × 6 in., cloth, 16s.

Although Thomas Telford (1757–1834) was the first president of the Institution of Civil Engineers and one of the founders of modern civil engineering, no satisfactory account of his life and works has been available. The present volume, by an eminent engineer whose great-grandfather was an associate of Telford's, is intended to remedy this state of affairs. The part that Telford played in the building of the British canal and road systems and his other engineering activities are described, and his life is presented as fully as possible. An annotated list of all his important works is included, as well as a bibliography. The illustrations are excellent.

Symposium on the Welding of Iron and Steel. 2 Vols. London, Iron and Steel Institute, 1935. Vol. 1, 676 pp.; Vol. 2, 974 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, £2 2 s.

These two large volumes contain the proceedings of a symposium, which was organized by the Iron and Steel Institute in conjunction with the other engineering societies of Great Britain and was held in May 1935. The objects were to review the position of welding in all its industrial aspects, to learn the problems encountered in welding by the various industries, to ascertain what research work is in progress, and to stimulate further efforts. The proceedings contain 150 papers upon practice and problems in the engineering industries; welding practice, technique, and apparatus; the metallurgy of welding; and specification, inspection, and testing. They form a valuable record of recent progress and present practice throughout the world, in all important industries.

Transportation by Water. By E. R. Johnson, G. G. Huebner, and A. K. Henry. New York and London, D. Appleton-Century Co., 1935. 585 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $5.

This volume discusses the economics of transportation by water and the business and governmental policies connected therewith. Facilities, agencies, services, business management, rates, and governmental regulation of transportation upon inland and marine waters are considered. The book is the outgrowth of two earlier books upon the subject by the same authors.

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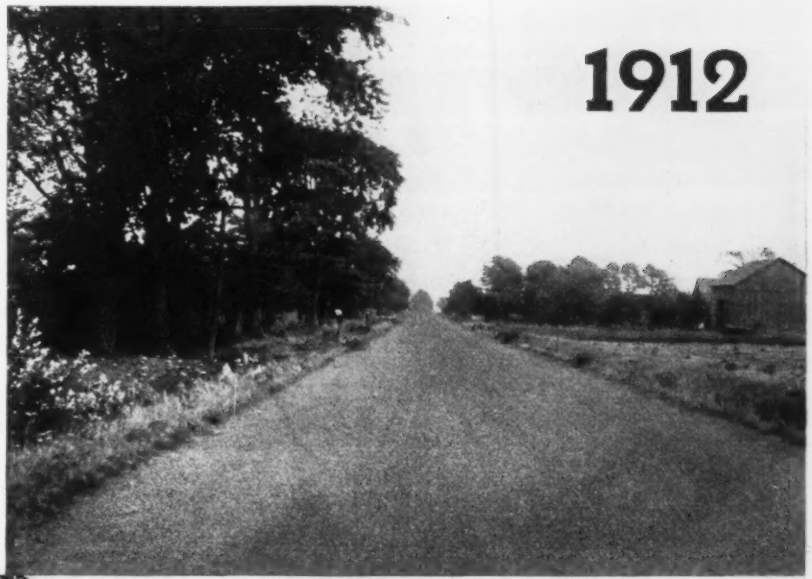

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CURRENT PERIODICAL LITERATURE

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BRIDGES

Highway, Oregon. Remarkable Series of Bridges on Oregon Coast Highway, C. B. McCullough. *Eng. News-Rec.*, vol. 115, no. 20, Nov. 14, 1935, pp. 677–679. Description of five structures under construction, including concrete deck arches and girders, concrete bowstrings and steel cantilever, with spans up to 793 ft in length; construction hinges; concrete bowstring arches; steel cantilever erection; pier architecture; vibrated concrete.

Highway, Submersible. Practical Notes in Connection with Construction of Reinforced Concrete Submersible Bridge Over River Nerbudda Near Jubbulpore, G. F. Walton and S. B. Gupta. *Indian Eng.*, vol. 96, no. 4, July 28, 1934, pp. 69–74. Concrete arch bridge of 14 spans, 50 ft to 105 ft in length, which will stand submersion of 15 ft, or more, at high water. Before Instn. Engrs.

Lift, Great Britain. G. Tees (Newport) Bridge, Middlesbrough, J. A. K. Hamilton and J. T. Graves. *Instn. Civ. Engrs.—Min. Proc.*, vol. 240, no. 5019, pt. 2, 1935, 34 pp., 1 supp. plate. Design and construction of 11-span steel truss bridge, 4,920 ft long, including lift span 265 ft long with vertical clearance of 120 ft; details of pier foundations; electrical and mechanical equipment of lift spans; total cost £426,841.

Military. Military Bridging, A. P. Sayer. *Instn. Civ. Engrs.—Special Lecture*, 1934, 23 pp., 3 supp. sheets. Principal factors to be considered in design and construction of temporary military bridges; load classification; adaptability of girder bridges; fighting crossing; kapok assault bridge; folding-boat equipment; pontoon equipment; small box girder and method of launching it; semi-permanent bridges; comparison of bridge lengths and road space; welding.

Railroad Structures, Iron and Steel. Report of Committee XV—Iron and Steel Structures. *Am. Ry. Eng. Assn.-Proc.*, vol. 36, 1935, pp. 631–780, (discussion) 986—1009. Specifications for steel railway bridges for fixed spans not exceeding 400 ft in length; impact-railway bridges; Bearing Value of Rollers, W. M. Wilson; Change in Grade of Structural Steel, A. W. Carpenter; Comments on Column Formula Recently Adopted by Iron and Steel Committee of American Railway Engineering Association, F. E. Turneaure; Elastic Stability of Plates Subjected to Compression and Shear, O. E. Hovey; Shears on Column Lacing, S. Hardesty; Live Loads for Multiple Track Bridges, H. C. Tammen; Live Loads and Unit Stresses for Bridge Design, S. Hardesty; Impact in Steel Railway Bridges, J. B. Hunley; Net Section of Riveted Tension Members, C. H. Chapin.

Steel; Continuous. Continuous Spans Favored for Kansas Highways, G. W. Lamb. *Eng. News-Rec.*, vol. 115, no. 21, Nov. 21, 1935, pp. 702–706. Practice of Kansas Highway Commission in design and construction of continuous span bridges of rolled-beam, plate-girder, and truss type, with savings estimated from 10 per cent to 30 per cent over simple spans; adjusting pier reactions of Spring River truss bridge by means of hydraulic jacks; bearing shoes and expansion details used on various types of continuous bridges; service experience.

Steel Truss, Catskill–Hudson, N.Y. Modern Construction Practices on Latest Hudson River Bridge. *Eng. News-Rec.*, vol. 115, no. 19, Nov. 17, 1935, pp. 640–642. Construction of steel-truss highway bridge over the Hudson River, between Catskill and Hudson, N.Y., consisting of 13 spans, totaling 4,900 ft in length, maximum span 800 ft; steel erection; deck concreting; personnel.

Steel Truss, Moving. Verschiebung der Reichsbruecke ueber die Donau bei Wien, L. Ilosvai. *Zentralblatt der Bauverwaltung*, vol. 54, no. 49, Dec. 5, 1934, pp. 766–767. Method of moving old-span steel-truss highway bridge over Danube River at Vienna, for distance of 26 m upstream; moved bridge is about 336 m long and weighs 4,800 tons; original site will be utilized for erection of new eye-bar suspension bridge, with main span of 241 m.

Steel Truss, Philippine Islands. Construction of Abra River Bridge, M. T. Lagunsad. *Philippine Eng. Rec.*, vol. 1, no. 4, 4th quarter, 1935, pp. 8–16 and 21. Design and construction of highway bridge consisting of four 240-ft through-riveted pettit truss spans, with reinforced-concrete 20-ft roadway, supported on two concrete abutments and three concrete piers; abutments are resting on solid rock foundation and piers, on three cylinders each.

Steel Truss, Reconstruction. Guy Derricks Lift Railway Spans Back Onto Piers After Flood, P. Emery. *Eng. News-Rec.*, vol, 115, no. 23, Dec. 5, 1935, pp. 772–773. Three washed-out 107-ft steel truss spans of Chicago, Burlington, and Quincy Railway bridge, near Republican City, Nebr., replaced on their piers by means of guy derricks having 60-ft masts and 50-ft booms.

Toll, Photo-Electric Control. Photo-electric Instruments Count Vehicles Crossing Cairo (Ill.) Toll Bridge, R. C. Wenz. *Instruments*, vol. 8, no. 10, Oct. 1935, pp. 254–255. Photo-electric-cell device to count cars crossing bridge and to signal amount of toll registered at toll house to inspector stationed at opposite end of bridge.

Wooden, Standards. Report of Committee VII—Wooden Bridges and Trestles. *Am. Ry. Eng. Assn.—Proc.*, vol. 36, 1935, pp. 781–837, (discussion) 1009–1014, 14 supp. plates. Simplification of grading rules and classification of timber for railway uses; grading specifications; structural joint, plank, and other framing members; overhead wooden or combination wooden and metal highway bridges; wooden trestles for heavy loadings; improved design of timber structures to give longer life with lower maintenance cost.

BUILDINGS

Earthquake Effects. Theory of Vibrations of Buildings During Earthquake, N. Biot. *Zeit. fuer Angewandte Mathematik u Mechanik*, vol. 14, no. 4, Aug. 1934, pp. 213–223. Relation between frequency spectrum of transient impulses and its effect on undamped elastic system is applied to earthquake-proof building with "elastic first floor." (In English.)

Earthquake Effects, India. Record of Reinforced Brickwork in Indian Earthquake, M. Vaugh and A. T. Mosher. *Eng. News-Rec.*, vol. 115, no. 22, Nov. 28, 1935, pp. 738–739. Data on Bihar earthquake of Jan. 1934; floors, ceilings, and lintels were undamaged though in many cases they were not tied in to connecting elements; lack of reinforcement in vertical walls was major cause of failure.

Library Buildings, Air Conditioning. Air Conditioning Modernizes Library; Promotes Efficiency; Protects Books, F. J. Cumming. *Heating Piping & Air Conditioning*, vol. 7, no. 12, Dec. 1935, pp. 565–567. Installation of year-round air conditioning at James J. Hill Reference Library in St. Paul, Minn., cooling accomplished by means of 52 F water from deep well; air treated in washer with alkaline solution for removal of sulfur dioxide; proper humidities maintained summer and winter.

Office Buildings, Air Conditioning. Modernizing with Air Conditioning, T. Mitchell. *Heating Piping & Air Conditioning*, vol. 7, no. 12, Dec. 1935, pp. 581–582. Air-conditioning installation in 10-story National Reserve Life Insurance Company office building; job includes 38 zones; three compressors in basement provide total capacity of 131 tons; condenser and receiver on roof directly under cooling tower; multiple-step controller selects proper grouping to match load.

Office Buildings, New York City. International Building, Rockefeller Centre, New York, R. Fleming. *Engineering*, vol. 140, no. 3641, Oct. 25, 1935, pp. 444–445. Brief illustrated description of building.

Structural Steel, Specifications. Erlass des preussischen Finanzministers betreffend Berechnungsgrundlagen fuer Stahl im Hochbau. *Zentralblatt der Bauverwaltung*, vol. 54, no. 40, Oct. 3, 1934, pp. 607–612. Rules, released by Minister of Finance of Prussia, on standard design of structural steel elements in building construction.

CITY AND REGIONAL PLANNING

Bibliography. Some Recent References (since 1928) on National and State Planning in United States, compiled by H. Merrill and J. T. Rubey and W. H. Heers. Nat. Resources Committee, Washington, D.C., Oct. 1935, 2 pp. Bibliography including 314 items from American literature.

Sanitary Engineering. Die Altstadt-Sanierung. *Zentralblatt der Bauverwaltung*, vol. 54, no. 39, Sept. 26, 1934, pp. 569–576. Symposium consisting of two articles by Woelz and E. Frank, discussing legal and technical means for regulation of sanitation and renovation of old buildings and old city quarters.

CONCRETE

Beams. La simplification du calcul exact de poutres rectangulaires en béton armé—armées en traction et en compression, K. S. Belaieff. *Travaux*, vol. 18, no. 23, Nov. 1934, pp. 493–496. Outline of simplified method for exact design of concrete beams of rectangular cross section reinforced for both tension and compression; tables of design values.

Refractory Materials, Cements. New Light Weight Refractory Concrete, N. J. Kent. *Heat Treatment & Forging*, vol. 21, no. 27, July 1935, pp. 343–344 and 349. Firecrete, developed by Johns-Manville Laboratories, is composed chiefly of pure clay of high alumina content calcined at high temperatures, enabling refractory to withstand temperatures up to 2,400 F; has unusually low heat-storage capacity and low thermal conductivity.

Retaining Walls. Report on Gravity Retaining Walls and Concrete Walls. *Instn. Structural Engrs.*, Dec. 1934, 44 pp. Price 1s. 6d. Study of forces acting thereon and notes on method of design; failures of retaining walls; wedge theory formulas; lateral pressure of clay; passive resistance of waterlogged ground; pressure on load-bearing brickwork; report on concrete walls.

DAMS

Concrete Gravity, Construction. Two 1,437-Ft Suspension Spans for Aggregate Belt at Coulee Dam. *Eng. News-Rec.*, vol. 115, no. 20, Nov. 14, 1935, pp. 674–675. Description of cableways for servicing belts running at speed of 400 ft per min, rated at 700 tons of concrete per hr.

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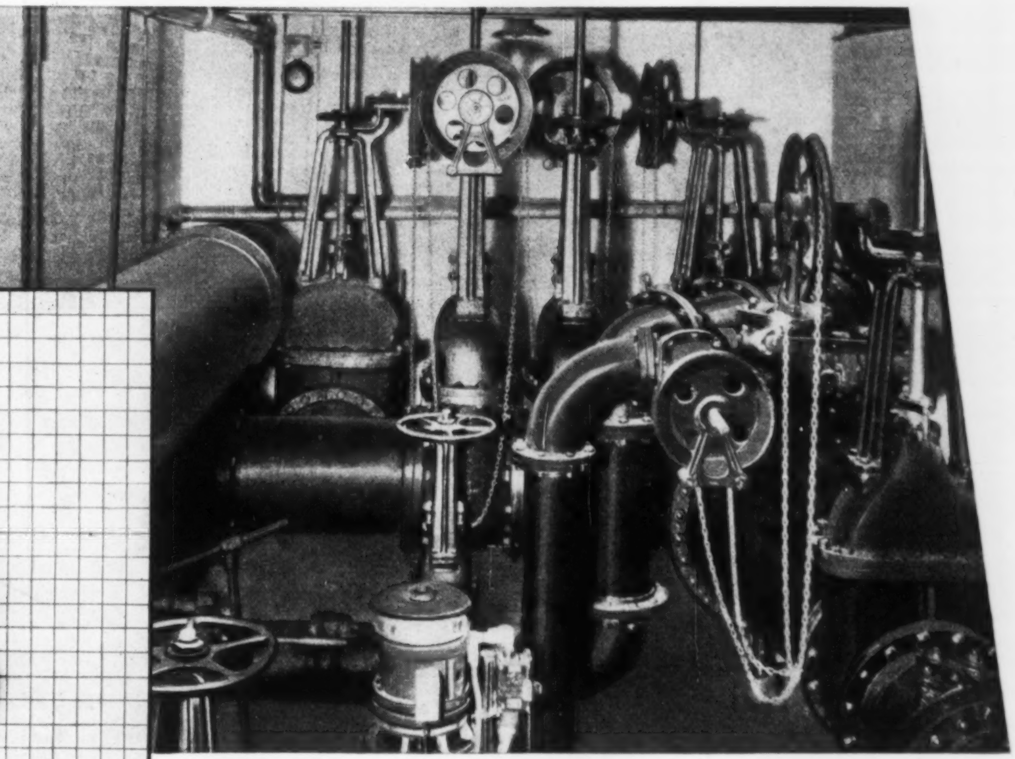

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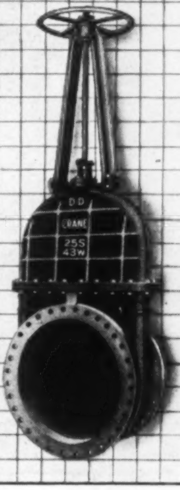

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MASONRY, SINGLE ARCH. Single-Arch Masonry Dams, G. B. Williams. *Engineer*, vol. 160, nos. 4163 and 4165, Oct. 25, 1935, pp. 420–422, and Nov. 8, pp. 470–471. Account of development of this system, with examples of arched dams that have been built during last 90 years.

MOVABLE, ROLLERS. Design Analysis of Roller Gates for Movable Dams, H. Cole. *Eng. News-Rec.*, vol. 115, no. 21, Nov. 21, 1935, pp. 718–722. Method of computing loads and structural stresses in roller gates, exemplified by analysis of 80-ft gate for Mississippi River navigation dam at Alton, Ill.; reaction analysis; stress analysis.

FLOOD CONTROL

AERIAL SURVEYING. Mapping Louisiana from Air, J. P. Dean. *La. Eng. Soc.—Proc.*, vol. 21, no. 3, June 1935, pp. 78–85. Aerial surveying methods used in making general utility topographic map of alluvial valley of Mississippi River for purposes of flood control.

CHINA. Improvement of Lower Huangho (Yellow River), L. Brandl. *Eng. Soc. China—Proc.*, vol. 33, 1934–1935, pp. 43–53, (discussion) 53A–53Q, 1 supp. plate. General discussion of methods of preventing levee breaks and general flood control on Yellow River, China.

TRAINING WALLS. Wire-Bound Rock Training Walls Solve Zion Park Flood Problem, T. C. Parker and F. A. Kittredge. *Eng. News-Rec.*, vol. 115, no. 20, Nov. 14, 1935, pp. 684–686. Torrential Virgin River freshets being held in defined channel, and eroding valley bottom is built up by use of walls of loose stone hooped and bound by steel netting; restoration by silting; cost data.

FLOW OF FLUIDS

FLOW METERS. Primary Elements for Sewage and Water Works Meters, L. D. Carlyon. *Water Works & Sewerage*, vol. 82, no. 11, Nov. 1935, pp. 375–378. Fundamental principles, applications, and relative merits of Venturi tube flow nozzle, and orifice as applied to measurement of sewage, sludge, water, and air; eccentric types of Venturis and orifices for measurement of sewage flow.

RUN-OFF. Beitrag zur Kenntnis des Abfluss-Gesetzes in den natuerlichen Stroemen, M. Lippke. *Zentralblatt der Bauverwaltung*, vol. 54, nos. 31 and 32, Aug. 1, 1934, pp. 423–426, and Aug. 8, pp. 440–445. Theoretical mathematical study of laws of run-off in natural streams with special reference to discharge records of German rivers.

FOUNDATIONS

NEW ORLEANS. WPA Survey of New Orleans Foundation Conditions at 200 Locations. *Eng. News-Rec.*, vol. 115, no. 14, Oct. 3, 1935, p. 469. New data on conditions in metropolitan area revealed by soil and foundation survey being carried out as WPA project.

PIERS, DESIGN. Design of Piers for Bridge or Sluice Dam: Investigation with Aid of Model Experiments. J. Allen and D. L. Deshpande. *Instn. Civ. Engrs.—Selected Eng. Papers*, no. 151, 1934, 26 pp. Model study of flow through hypothetical barrage, consisting of 130 sluices, with overall length of 6,825 ft, built on rock plateau; determination of differences in water levels upstream and downstream of sluices; distribution of velocities; influence of shape of piers; effect of changing pitch of piers.

PILES, STEEL, SHACKLES. Safety Shackle Pin Adopted at Grand Coulee Dam. *Eng. News-Rec.*, vol. 115, no. 19, Nov. 7, 1935, p. 642. Description of quickly operating safety shackle pin which cannot fall out, developed for placing sheet piling on Grand Coulee Dam.

PILES, WOODEN, PRESERVATION. Creosoted Piles Salvaged for Re-Use After 28 Years in New York Harbor. *Wood Preserving News*, vol. 13, no. 8, Aug. 1935, pp. 111–113. Dismantling in early summer of 1935 of long-unused Canal Street ferry terminal at Staten Island, New York, providing example of effectiveness of creosoted piles in resisting both decay and marine-borer attack.

HYDRAULIC ENGINEERING

HYDRODYNAMICS. Study of Relation Between Pulsations at Two Points of a Stream, I. M. Burgers and M. A. Velikanov. *Izvestiya Nauchno-Issledovatelskovo Instituta Hydrotechniki*, vol. 12, 1934, pp. 24–29. Mathematical analysis of anemometer measurements of simultaneous, instantaneous velocities at two points of stream, made at Delft aerodynamical laboratory, Netherlands; coefficient of correlation found to vary inversely with distance between points and directly with average velocity of stream; amount of eddy masses grows with mean velocity of stream. (In Russian, with brief abstract in English, p. 29.)

HYDRO-ELECTRIC POWER PLANTS

DEVELOPMENTS. Some Considerations Governing Undertaking of Hydro-Electric Power Developments, E. D. Gray-Donald. *Eng. J.*, vol. 18, no. 11, Nov. 1935, pp. 497–501. Trend towards combination of power development with flood control; respective advantages of steam and hydro-electric development; effect of various types of load; new uses for electric energy; factors affecting location of power sites and control of their water supply. Before Eng. Inst. Canada.

EROSION. Erosion at Arapuni, J. A. Bartrum. *New Zealand J. Science & Technology*, vol. 17, no. 1, July 1935, pp. 391–397. Description of erosion at site of power plant below dam; spiral pot holes; miniature sink holes; mutual notching of boulders; slotting of rocks by vibrating steel bars; wave-cut benches on shores of Lake Arapuni. Bibliography.

HYDROLOGY, METEOROLOGY, AND SEISMOGRAPHY

EARTHQUAKES. Recent Advances in Seismology, F. J. W. Whipple. *Nature (London)*, vol. 136, no. 3446, Nov. 16, 1935, pp. 782–784. Brief review of research and observations; comment on prevalence of earthquakes in Pacific zones.

EARTHQUAKES, INDIA. Causation of North Bihar Earthquake (1934), K. K. Sen Gupta. *Geol. Min. & Met. Soc. India—Quarterly J.*, vol. 16, no. 4, Dec. 1934, pp. 113–126. Observed phenomena; nature of damage, caused directly by longitudinal and transverse waves and indirectly by seismic waves; mechanism of folding and faulting in Himalayan Chain; change of Ganges drainage.

TIDES, GAGES. Roberts Offshore Tide Gage, E. B. Roberts. *U. S. Coast & Geodetic Survey—Field Engrs. Bul.*, no. 7, June 1934, pp. 8–17. New type of gage is completely automatic instrument in pressure-tight container that can be lowered to bottom and left there, undisturbed by waves or current; photographic camera incorporated in gage; operating experience satisfactory.

UNITED STATES. Reports and Papers Section of Hydrology. *Nat Research Council* (Am. Geophys. Union—Trans.) mtg., Apr. 25–26, 1935; pt. II, Aug. 1935, pp. 366–530. Annual reports of permanent research committees for 1934–35 on snow, glaciers, evaporation, absorption, and transpiration, rainfall and run-off, physics of soil moisture, underground waters, dynamics of streams, and chemistry of natural waters; Flow of Water in Thin Sheets, M. R. Lewis and E. H. Neal; Energetics of Stream Transportation of Solids, H. L. Cook; Observations of Sorting of River Sediments, L. G. Straub; Diversity of Current Direction and Load Distribution on Stream-Bends, H. M. Eakin; Relationships Between Slope Length, Surface Run-off, and Silt Load of Surface Run-off, G. W. Musgrave; Silt in Open Channels, J. E. Christiansen; Models of Estuaries, M. P. O'Brien; Sedimentation on Clearwater River, Idaho, J. P. Thomson; Periodic Measurements of Groundwater Level in Nebraska, L. K. Wenzel; Need for Nationwide Program of Observation Wells, O. E. Meinzer; Further Tests of Permeability with Low Hydraulic Gradients, V. C. Fishel; Groundwater Studies in Humid and Semi-arid Parts of Texas Coastal Plain, S. F. Turner and P. Livingston; Evaporation from Large Water Surfaces in California and Nevada, S. T. Harding; Storage Loss and Recovery of Missouri River Discharge During Drought of 1934, H. C. Beckman; Use of Burt Phototube in Integrating Pyrheliometer, N. W. Cummings; Relation Between Lowering of Piezometric Surface and Duration of Discharge of Well Using Groundwater Storage, C. V. Theis; Piezometric Surface of Artesian Water in Florida, V. T. Stringfield; Periodogram Analysis of Rainfall Records of Pacific Coast, D. Alter.

IRRIGATION

CANALS, DROPS. Improved Type of Flumed Fall, T. Blench. *Indian Eng.*, vol. 96, no. 7, Aug. 18, 1934, pp. 135–139. Method of design; principle of divergence; collapse and spread of jet emerging from throat onto horizontal floor; position of standing wave and water profile at flume; advantages of designs embodying principle of divergence; friction losses.

INDIA. Report on Ujar River Project, Kotah, S. K. Gurtu. *Indian Eng.*, vol. 96, no. 14, Oct. 6, 1934, pp. 268–274. Outline of irrigation project involving construction of two weirs up to 76 ft in height, which will cost about 1,260,000 rupees.

PUMPING PLANTS, EGYPT. Pumping Stations on Nile, B. Hiltmann. *Siemens Rev.*, vol. 11, no. 4, 1935, pp. 103–107. Discussion of series of electric pumping stations for irrigation purposes as built by Siemens and Schuckert, Egyptian branch; current for operating these pumping stations is obtained from existing steam power station at Idfu, half way between Luxor and Asswan, about 500 miles south of Cairo.

MATERIALS TESTING

COLUMNS, STEEL, TESTING. Tests of Steel Tower Columns for George Washington Bridge, A. H. Stang and H. L. Whittemore. *U. S. Bur. Standards—J. Research*, vol. 15, no. 3, Sept. 1935 (RP831), pp. 317–339, 4 supp. plates. Investigation of strength and other properties of large fabricated columns of bridge built by bridge department of Port of New York Authority; columns made of carbon steel, silicon steel, and carbon-manganese steel and tested in hydraulic compression machine at bureau.

MODELS. Predicting Strength of Structures from Tests of Plaster Models, R. J. Roark and R. S. Hartenberg. *Univ. Wis.-Eng. Experiment Station Series—Bul.*, no. 81, 1935, 51 pp. Selection of suitable material, development of technic for making and testing models and specimens; comparison of mechanical properties of model material with those of structural materials; comparison of tests on fairly complicated structures with tests on models thereof to ascertain accuracy and reliability of this method of strength prediction. Bibliography.

PORTS AND MARITIME STRUCTURES

DOCKS, CAPE TOWN, SOUTH AFRICA. Cape Town Docks. *Engineer*, vol. 160, no. 4166, Nov. 15, 1935, pp. 525–526. Brief description of very large scheme, which, though not official, is being investigated by technical officers of Railways and Harbours Administration; chief features are 4,200-ft wharf to accommodate from five to six 20,000-ton ships, new fishery harbor, drydocks, and new oil berth.

EXCAVATING MACHINERY, ROCK BREAKERS. Notes on Operation of Lobnitz Rock Breaker, C. S. MacLean. *Eng. J.*, vol. 17, no. 12, Dec. 1934, pp. 518–522. Rock breaker dropping 15-ton chisel shattering rock at bottom of channel; advantages and limitations of method; procedure for fixing position of cut and allowing for variations of tidal level during operation. Before Eng. Inst. of Canada.

GDYNIA, POLAND. Gdynia—Poland's New Seaport. *Naut. Gaz.*, vol. 125, no. 20, Sept. 28, 1935, pp. 9–11. Port can accommodate 50 ocean-going vessels; divided into outer port, formed by wharves, and inner port, built by excavation; port facilities.

INDIA. Vizagapatam Harbour: Pt. 1: General Notes, W. C. Ash: Pt. II: Construction, O. B. Rattenbury. *Instn. Civ. Engrs.—Advance Paper*, no. 5007, 1935, 82 pp., 3 supp. plates. Design and construction of port between Calcutta and Madras at cost of about £1,700,000; problem of entrance channel; physical, geological, and nautical features; coordinate survey; reclamation; quay wall; protective works; problems at opening of port; description of dredge and dredging operation, including cost data and rate of wear of dredge equipment.

JAFFA, PALESTINE. Jaffa Harbour Works. *Civ. Eng. (London)*, vol. 30, no. 352, Oct. 1935, pp. 313–315, 2 supp. plates. Construction of breakwater and sea walls enclosing area of about 11 acres, also reclamation of area of 11½ acres; construction of transit and citrus inspection sheds; statistical data on traffic.

PORTLAND, ORE. Portland, Oregon, Has Ample Facilities for Ocean Trade, P. Thurmond. *Mar. Rev.*, vol. 65, no. 10, Oct. 1935, pp. 10–12 and 14. Brief illustrated description of some of its facilities, including traveling cranes and municipal terminal; rail lines cooperate.

RAILROAD STRUCTURES, HARBORS, AND RIVERS. Report of Committee XXV—Waterways and Harbors. *Am. Ry. Eng. Assn.—Proc.*, vol. 36, 1935, pp. 211–241, (discussion) 1040–1047. Revision of manual; definitions; specifications for construction of river-bank protection types in common use; fender systems for protecting wharves; ore docks or piers on Great Lakes for loading vessels by gravity; harbor structures; economic principles involved in clearances over navigable waterways; cost to railways for construction, maintenance, and operation of bridges over waterways.

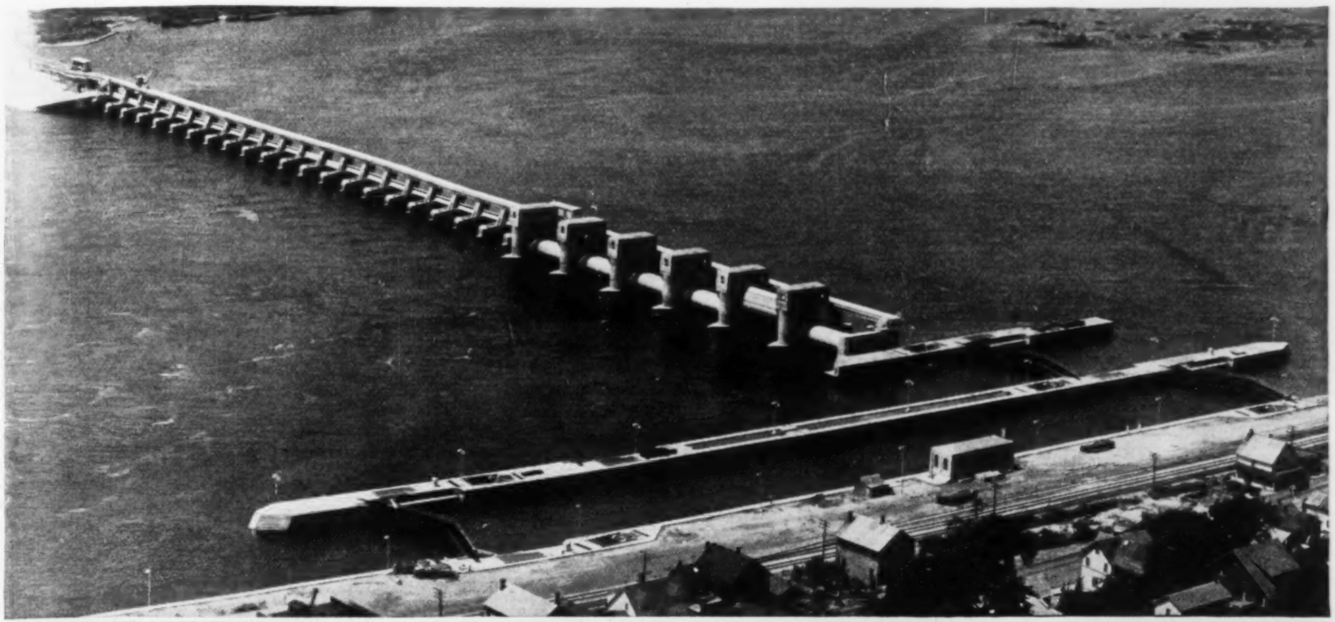
RETAINING WALLS, CONCRETE. Precast Concrete Cribbing for Small Retaining Wall. *Eng. News-Rec.*, vol. 115, no. 17, Oct. 24, 1935, pp. 578–579. Construction of small crib retaining wall at water-works inlet of Vancouver, B.C.; cost data and man-hours.

ROADS AND STREETS

BITUMINOUS. Bituminous Surface Treatment of Rural Highways, F. M. Hanson. *New Zealand Soc. Civ. Engrs.—Proc.*, vol. 21, 1934–1935, pp. 89–179, (discussion) 179–220. Review of New Zealand practice, including result of original tests; experience with kerosene treatment; features of New Zealand roller compacted water-bound macadam; traffic compacted roads; bituminous emulsion light "armourcoat"; heavy duty sealing; non-skid, one-coat sealing.

In Alma Dam and Lock,

Upper Mississippi River Canalization Project



BETHLEHEM *Steel Sheet* PILING

ONE of the most far-reaching river improvement projects ever undertaken is in progress on the upper Mississippi. At Alma, Wis., at Alton, Ill., and at 21 other points along its shallow, island-filled upper reaches, locks and dams are rising to form a 9-ft. channel, 300 ft. wide and 650 miles long.

To establish controlled pools and guard against the possibility of excessive flood damage, dams below the Twin City Dam are of the low, movable type, with tainter or rolling gates. Two views of Lock and Dam No. 4 at Alma, first part of the project to be completed, appear on this page.

Bethlehem Steel Sheet Piling was used throughout in the construction of this dam and lock—for the box-type cofferdams, for the dikes connecting the dam to the shore, for the permanent cut-off wall under the lock walls and along the dam. The total tonnage of Bethlehem Piling was 5100 tons, of which 3600 tons are permanently installed.

At several other points along the Mississippi River the strength of Bethlehem Steel Sheet Piling, its permanence, economy and easy-driving qualities have led to its use for identical purposes. There are projects in many localities, involving the retention of earth or water, in which Bethlehem Steel Sheet Piling offers an equally simple, economical solution of the problems involved.

Bethlehem Steel Sheet Piling was used in the box-type cofferdam and in the cut-off walls beneath lock and dam.

United States Engineers' Office, St. Paul, Minn.; United Construction Company, General Contractors.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

GENERAL OFFICES: BETHLEHEM, PA.

CANADA. Extensive Pioneer Roadbuilding in Progress in Canada. *Eng. News-Rec.*, vol. 115, no. 23, Dec. 5, 1935, pp. 780–782. Symposium consisting of two papers: Closing Ontario Gap in Trans-Canada Highway, A. C. Jameson; Quebec Starts Roadbuilding to Its Rich Mineral Lands, R. F. Legget.

CONCRETE. Structural Design of Concrete Pavements—II, L. W. Teller and E. C. Sutherland. *Pub. Roads*, vol. 16, no. 9, Nov. 1935, pp. 169–200. Observed effects of variations in temperature and moisture on size, shape, and stress resistance of concrete pavement slabs; stresses caused by restrained temperature and moisture warping; factors affecting pavement temperature; relations between temperature warping and subgrade pressure; effect of applied loads on warped pavements; theoretical and measured stresses compared; merits of thickened-edge design.

EARTH. Road-Base Stabilization with Portland Cement, W. H. Mills, Jr. *Eng. News-Rec.*, vol. 115, no. 22, Nov. 28, 1935, pp. 751–753. Test sections of cement-stabilized-soil bases for bituminous surfaces in South Carolina, indicating possibilities that warrant extension of investigation; field experiments.

HIGHWAY SYSTEMS, GERMANY. Die Reichsautobahnen. *Zentralblatt der Bauverwaltung*, vol. 54, no. 37, Sept. 12, 1934, pp. 535–539. Outline of Germany's new highway system now in course of planning and construction; 1,500 km of new highway are under contract and 5,000 km more are planned.

HIGHWAY SYSTEMS, ITALY. Development of Roads of Italy, B. P. Root. *Eng. News-Rec.*, vol. 115, no. 20, Nov. 14, 1935, pp. 665–669. Extension and improvement of Italian highways in last 10 years; administration organization and policies; notes on principal recently completed highways totaling 282 miles in length; road building in Italian Africa.

HISTORY. Via Appia in Days When All Roads Led to Rome, A. C. Rose. Smithsonian Instn.—Annual Report of Board of Regents, 1935, pp. 347–370, 4 supp. plates. History of highway system of Roman Empire with special reference to Via Appia; character of traffic; administration of express service; legal load restrictions upon vehicles; distinguishing characteristics of Roman roads; description of model of Via Appia; cost of construction; sources of highway revenue; disintegration of roads during Middle Ages. Bibliography.

MACADAM. Revolutionary Experiment in Road Surfacing, E. P. Little. *Indian Eng.*, vol. 96, nos. 21 and 24, Nov. 24, 1934, p. 415, and (discussion) Dec. 15, p. v. Original experiment leading to conclusion that position of material in water-bound macadam should be reversed.

MOUNTAIN. Geologische Randbemerkungen zum Verkehrswegeban im Hochgebirge, J. Stiny. *Zeit. des Oesterreichischen Ingenieur- u. Architekten-Vereines*, vol. 86, nos. 29–30, July 27, 1934, pp. 171–174. Bearing of geology and climate of mountainous regions on design and construction of highways through them. Bibliography.

MOVING. Moving Seven Miles of Pavement Twelve Feet Sidewise, S. Johannesson. *Eng. News-Rec.*, vol. 115, no. 23, Dec. 5, 1935, pp. 767–771. Concrete pavement slab 14$^1/_2$ ft wide shoved 12 ft to one side and rebedded to form part of widened Brunswick Pike (N.J. 26, USI) south of New Brunswick; slab is cut across at intervals of 400 to 500 ft; flattened hose is inserted in open joint and inflated by compressed air, moving slab; mud-jack outfit raising slab by pumping cement-loam grout through drilled holes.

RECONSTRUCTION. Progressive Road Widening Planned for Indiana, J. W. Wheeler. *Eng. News-Rec.*, vol. 115, no. 23, Dec. 5, 1935, p. 773. Plan for reconstruction of Indiana state highways having worn-out pavements by adding new traffic lanes on their sides and practically abandoning old pavements.

SEWERAGE AND SEWAGE DISPOSAL

ACTIVATED SLUDGE, THEORY. Review of Activated Sludge Theory, G. P. Edwards. *Sewage Works J.*, vol. 7, no. 1, Jan. 1935, pp. 17–22. Review of recent experimental studies and theoretical interpretations. Bibliography. Before New England Sewage Works Assn.

ACTIVATED SLUDGE, TREATMENT. Activated Sludge Treatment with Extremely Low Solids, G. M. Ridenour. *Sewage Works J.*, vol. 7, no. 1, Jan. 1935, pp. 29–35. Experimental study of plant scale operation with solids in amounts as low as 150 ppm; minimum amounts of solids which can be maintained under continuous plant operation in "active" condition; relative "unit efficiency" of purification of these low solids; settling characteristics of sludge floc formed.

AERATION. Removal of Hydrogen Sulphide in Sewage by Aeration, W. S. Mahlie. *Sewage Works J.*, vol. 7, no. 1, Jan. 1935, pp. 91–95. Results of study at sewage treatment works at Ft. Worth, Tex.

ANALYSIS. Rapid Determination of Suspended Solids in Activated Sludge by Centrifuge Method, L. R. Setter. *Sewage Works J.*, vol. 7, no. 1, Jan. 1935, pp. 23–28. Accuracy of Gooch filter method; comparison of volume of centrifuged solids and weight of solids by Gooch filter; correlation of centrifuged sludge and suspended solids. Bibliography.

CHLORINATION. Effect of Chlorine on Activated Sludge. II—Partial Chlorination, W. Rudolfs and I. O. Lacy. *Water Works & Sewerage*, vol. 82, no. 5, May 1935, pp. 175–177. Oxygen demand values: oxygen requirements of effluent and sludge during different incubation periods; percentage in increase or decrease of oxygen requirement with varying degrees of chlorination.

FILTERS. Mechanical Filtration of Sewage, P. B. Streander. *Water Works & Sewerage*, vol. 82, no. 7, July 1935, pp. 252–257. Filter hydraulics; filtering materials and types of filters; upward and downward flow-type filters; downward flow backwash filter; vacuum-type filters; filter-bed arrangement; combined rectangular tanks and filters; separate settling and filtration tanks; rates of sewage filtration; application of mechanical filters. Bibliography.

NETHERLANDS. Annual Report, Government Institute for Purification of Waste Waters, 1933. H. J. N. H. *Kessener Sewage Works J.*, vol. 7, no. 1, Jan. 1935, pp. 135–138. Abstract of official report on sewage disposal and stream pollution in Netherlands; sewer rental laws; stream pollution; trade waste treatment; advice given and operation of plants; research.

NEW YORK. Spring Meeting, New York State Sewage Works Association. *Water Works & Sewerage*, vol. 82, no. 7, July 1935, pp. 247–251. Proceedings including abstracts of following papers: Settling and Filtering of Activated Sludge Effluents at Chicago (North Side) Plant, S. I. Zack; Pumping Sewages and Sludges, H. Ryon; Effects of Sewage Gases on Concrete, A. F. Pistor; Experiments on Settling and Filtering of Raw Sewage vs. Settling Alone, W. Rudolfs, J. H. Brendlen, and W. T. Carpenter; Construction of Sewage Treatment Plant with Work Relief Funds, R. C. Wheeler; Day at Sewage Treatment Plant, F. McCann; Experiences at Newark (N.Y.) Sewage Treatment Plant, T. J. Smith; Experiences with Activated Carbon at Garden City, L.I., A. H. Rogers; Grease Removal at Hamilton, N.Y., L. Waldron.

PLANTS, STANDARDS. Time-Saver Standards. *Am. Architect*, vol. 147, no. 2639, Nov. 1935, pp. 75–87. Standard data on sewage-disposal systems, including general design, septic tanks, sludge drains and pits, leaching cesspools, subsoil disposal beds, and sand filters.

STRUCTURAL ENGINEERING

EARTHQUAKE EFFECT. Recommendations of Board of Fire Underwriters of Pacific for Earthquake Resistant Design of Buildings, Structures, and Tank Towers, H. M. Engle and J. E. Shield. Published by Board of Fire Underwriters of Pacific. 1934, 44 pp. figs., diagrs., charts, tables, supp. plates.

EARTHQUAKE EFFECT, TESTS. Man-Made Earthquakes, F. P. Ulrich. *Eng. News-Rec.*, vol. 115, no. 20, Nov. 14, 1935, pp. 680–681. Chief of California Seismological Program, U. S. Coast and Geodetic Survey, reports on methods of testing effect of earthquakes by imparting artificial oscillations to towers, buildings, bridges, and dams; wind vibrations and forced vibrations; effects of resonance; vibration records of 4-story, reinforced-concrete warehouse with hollow-tile partitions; vibrations from explosion and traffic.

GEODETIC SURVEYING, TRIANGULATION. Wooden Towers for Triangulation, E. R. McCarthy, Jr. *U. S. Coast & Geodetic Survey—Field Engrs. Bul.*, no. 8, Dec. 1934, pp. 56–59. Detailed standard designs of lighter guyed and unguyed triangulation towers for geodetic surveying in Louisiana marshes, up to 100 ft in height.

TUNNELS

RAILROAD, BALTIMORE. New Tunnel at Baltimore, Pennsylvania Railroad. *Ry. Gaz.*, vol. 63, no. 16, Oct. 18, 1935, pp. 629–630. Claimed to be largest shield tunnel driven in soft ground, it is mainly lined with cast-iron semi-circular arch resting on concrete side walls and inverted slab.

RAILROAD, FREIGHT TRANSPORTATION. Underground Freight Railways of Chicago, A. W. Arthurton. *Ry. Gaz.*, vol. 63, no. 14, Oct. 4, 1935, p. 531. System which distributes light goods and coal throughout commercial center of Chicago, in many cases direct to business houses; tunnel rolling stock comprises 150 electric locomotives and 3,300 freight cars.

SUBWAYS, MOSCOW. Construction of New Moscow Underground Railway. *Civ. Eng. (London)*, vol. 30, no. 352, Oct. 1935, pp. 305–311. History of Moscow subway and description of first recently opened section totaling 5.34 miles in length; subway has minimum of curves, as compared with other existing systems, and all stations are "on the straight"; tunnels are widest in world; shield tunneling; ventilation; hydraulic insulation; constructive features; spare sidings and junctions; stations.

WATER PIPE LINES

CLEANING, COMPRESSED AIR. Blowing Out Service Lines, S. H. Davis. *Water Works & Sewerage*, vol. 82, no. 10, Oct. 1935, pp. 344–345. Practice of Benwood & McMechen Water Co. Benwood, W.Va., in cleaning out service pipe lines with compressed air, using pressures of 600 to 800 lb per sq in.

CLEANING, EVANSVILLE, IND. Experiences in Water Main Cleaning at Evansville, Ind., C. Streithof. *Water Works & Sewerage*, vol. 82, no. 11, Nov. 1935, pp. 394–395. Methods and results of cleaning water mains, 12 to 20 in. in diameter, with so-called "rabbit" device. Before Am. Water Works Assn.

FRICTION. Studies of Pipe Friction and Capacity Loss Reported. *Eng. News-Rec.*, vol. 115, no. 17, Oct. 24, 1935, pp. 573–574. Results of 2-year investigation by committee of New England Water Works Assn., revealing large differences between predicted and actual loss in capacity of cast-iron pipe; pH values of water correlated with rate of loss and corrective measures suggested; tar-coated cast-iron pipe; effect of water quality; cement-lined pipe coefficients; bitumasic enamel lining; lining mains in place; concrete pipe.

WELDING. All-Welded Irrigation Pipe. *Welding Engr.*, vol. 20, no. 10, Oct. 1935, pp. 32–33. Three installations of $^1/_4$-in. steel pipe, 10 ft inside diameter, on main canal of Beardsley irrigation project of Maricopa County Municipal Water Conservation District No. 1, west of Phoenix, Ariz., are of particular interest because of unusual type of expansion joint used, and fact that both pipe and structural steel supports are all-welded; pipe shop-welded and shipped in 30-ft lengths; holes cut in pipe to pass welding cables through.

WATER RESOURCES

NEW HAMPSHIRE. New Hampshire Water Board Outlines Conservation Plan. *Eng. News-Rec.*, vol. 115, no. 18, Oct. 31, 1935, p. 600. Program of board charged with construction of dams and other necessary works for conservation, storage, and utilization of water.

UNDERGROUND, CALIFORNIA. Underground Water Storage in California's South Coastal Basin. *Eng. News-Rec.*, vol. 115, no. 22, Nov. 28, 1935, pp. 733–738. Photography, geology, and hydrology of underground gravel reservoirs of southern California; underground storage capacity; specific yield and specific retention; classification of materials; available underground storage.

WATER TREATMENT

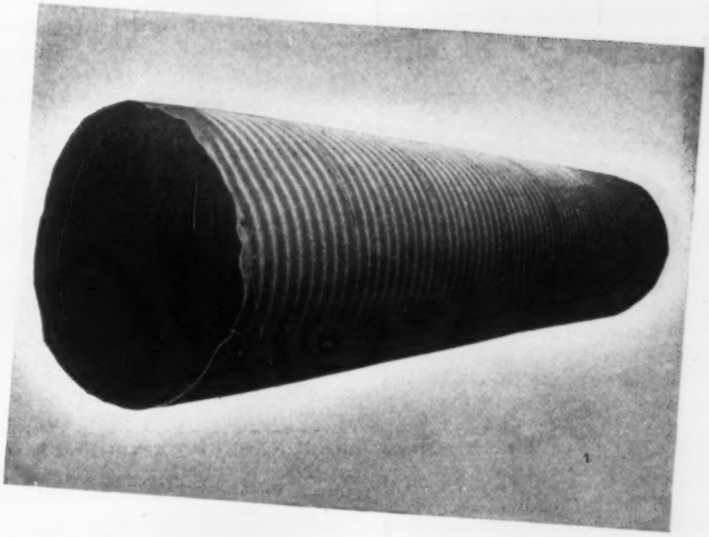
ANALYSIS, CHLORINE DETERMINATION. Improved Standards for Residual Chlorine Tests, R. D. Scott. *Water Works & Sewerage*, vol. 82, no. 11, Nov. 1935, pp. 399–400. Chief chemist of Ohio State Department of Health, reports on procedure of standards preparation. Before 15th Ohio Annual Conference on Water Purification. Bibliography.

OZONE. Ozone Solves Color, Odor, and Taste Problem in Hobart Plant, T. O. Ferkinhoff. *Am. City*, vol. 50, no. 11, Nov. 1935, pp. 47–48. Features of ozonator installation at Hobart, Ind., serving population of 6,500; data on power consumption.

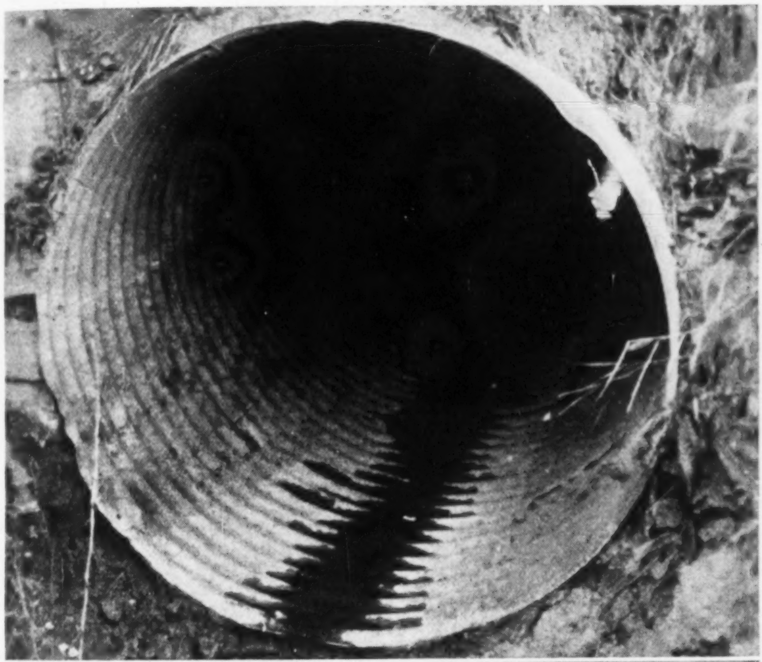
WATER WORKS ENGINEERING

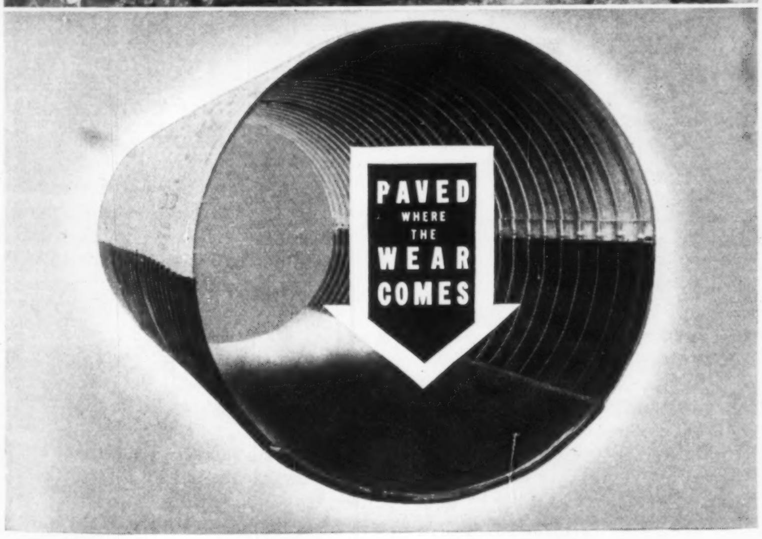
UNITED STATES. A.W.W.A. Convention Topics. *Water Works & Sewerage*, vol. 82, no. 7, July 1935, pp. 242–246. Concluding installment of proceedings; abstracts of following papers: Dams and Pipe Lines, T. H. Wiggin; Developments in Water Distribution Practice, W. W. Brush; Developments in Water Purification and Treatment, L. H. Enslow; Bouquet Canyon Dam and Inlet and Outlet Pipe, W. W. Hurlbut; Design and Construction of Morris Dam, S. B. Morris; Engineering Problems in Connection with Raising of O'Shaughnessy Dam, San Francisco Water Supply, L. W. Stocker; Abatement of Pollution by Acid Drainage from Mines, E. S. Tisdale; Committee on Hazards to Plant and Personnel from Chlorine and Other Water Supply Chemicals, M. C. Smith.

Here's the first corrugated pipe—made and installed in 1896, near Crawfordsville, Ind.—removed for exhibition, after 28 years in the ground.



3 *Events* THAT MADE DRAINAGE HISTORY





IN 1896: Many of the objections to existing types of drainage structures were eliminated by the invention of corrugated metal pipe. Its long, light-weight sections brought about immediate savings in hauling and installation costs. Moreover, due to its flexibility and sturdy joints, corrugated pipe soon proved its ability to stand up where other types couldn't take it. And it has continued to prove its superior strength *for 40 years!*

IN 1906: The development of rust-resisting ARMCO Ingot Iron created a high standard of durability for corrugated pipe. In fact, many of these pure iron drains are sound and strong today—after *30 years of service.*

IN 1926: ARMCO engineers raised the standard of corrugated pipe still higher, by putting a thick bituminous pavement in the bottom, where the wear comes. This improved product—known as ARMCO Paved Invert Pipe—gives you the 40-year strength of corrugated metal; the 30-year durability record of pure iron; plus an *extra 10 years* of service, already established by the protected bottom. No wonder more and more engineers and public officials are turning to ARMCO Paved Invert Pipe, for every drainage purpose. It costs less because it lasts longer. Make us prove it.

Above: After 30 years of service, this ARMCO pure iron culvert is still functioning 100%.

Below: ARMCO Paved Invert Pipe—paved where the wear comes, with a special bituminous material.

ARMCO

ARMCO CULVERT MANUFACTURERS ASSOCIATION • • • Middletown, Ohio

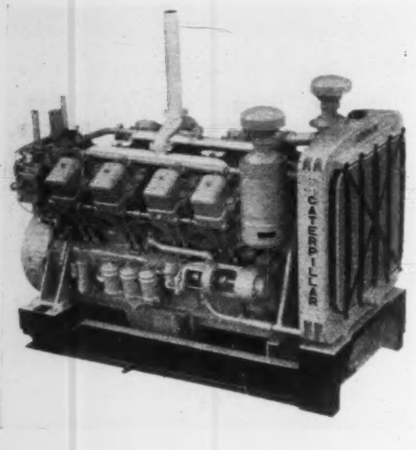
Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

V-8-Heads "Caterpillar's" New Diesel Engine Line

EXPANDING the range of power in its Diesel engine line, Caterpillar Tractor Company of Peoria, Ill., announces three new models, the largest being of V-type, 8-cylinder design to be produced solely as a stationary installation.

For the first time in its three years of industrial engine building, the company is manufacturing a product exclusively for the stationary power user. Caterpillar now manufactures five sizes of Diesel engines ranging from 44 to 160 maximum bhp, and to meet growing production, has established an industrial engine division.



The new models are the D17000, V-type, 8-cylinder, 160 hp; the D6600, 3-cylinder, 60 hp, and the D4400, 4-cylinder, 44 hp. These three, with the present 6-cylinder D13000 of 125 hp and the 4-cylinder D8800 of 77 hp, comprise the company's current Diesel engine line. Of the newcomers, the D6600 is in general production and shipments of the D17000 and D4400 will begin about March 15, according to the announcement.

The D17000 is the outgrowth of a demand for increased power by users of larger engines, and is declared to be ideally suited where compactness is needed, such as in shovels, industrial locomotives, compressors, and crushers.

This new product broadens greatly the field of usefulness of the "Caterpillar" engine line. The D17000 will exceed the D13000, present largest model, by 35 hp. This added power extends the work of these Diesels. In construction, the engine will power 2 and 2$^1/_4$-yd shovels and draglines. As a source of electric current, it will be offered as a unit with an 80-kw generator, an announcement of interest to those smaller cities which purchase Diesel engines to power their municipal plants. In general industrial use, the D17000 will drive larger gins, pumps, flour mills, and refrigerating plants.

The D4400 industrial engine extends the other end of the "Caterpillar" line, and is expected to find an important place in many fields where portable power is in demand. Considerably lighter in weight and having higher speed than its four companion engines, it is particularly adapted to such tasks as the powering of a sawmill, $^1/_2$ to $^3/_8$-yd shovels, or a 20-kw generator. Its dimensional advantages combined with a much lower initial cost than other members of the Diesel engine line, are factors that make it economical for a large number of small power users.

Next above the D4400 in power is the 60 hp D6600. This engine has the same bore, stroke, and governed rpm as the three Diesel units bracketed above it. Having 16 hp more than the D4400, and 20 hp less than the D8800, the D6600 fills an important place in the power spacing of the five sizes. It will power a 30-kw generator, a $^3/_4$-yd shovel and a wide variety of jobs in industry and construction.

A new booklet illustrates and describes three sizes of Caterpillar Diesel electric direct-connected generator sets. Copies of this booklet may be obtained from the manufacturers.

No changes are announced in the company's two spark-ignition industrial engines, the 9500-G and 6500-G. Those engines, built to operate on a wide variety of liquid fuels or natural gas, have met with wide popularity in their fields, the manufacturer stated.

New Welders Combine Safety and Efficiency

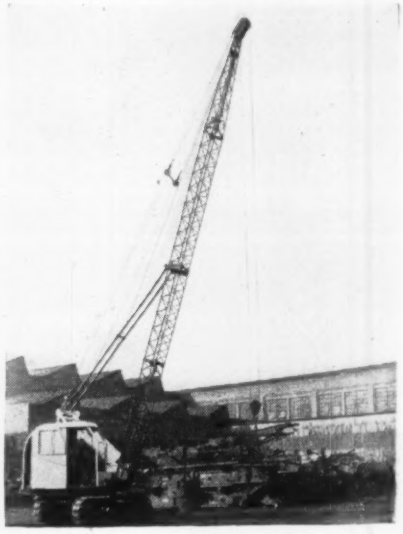
A RECENT announcement from the Westinghouse Electric & Manufacturing Company claims many improvements for their new Flexarc d-c welder. Equipped with a single dial preset control with which the welding current can be set to the exact number of amperes, this welder is able to maintain an absolutely constant arc in spite of speed changes of the driving motor caused by line fluctuations. Open circuit voltage, well below hazardous values, provides safety for the operator yet retains all the desirable arc characteristics usually associated with high open circuit voltage. The moment the arc is struck, the set adjusts itself immediately to the required preset value.

The Flexarc welder is a sturdy, compact unit designed for general welding service or production work with bare, dust coated, or heavy coated electrodes. The arc is extremely stable and adjusts itself automatically to varying conditions producing strong, uniform welds equally well on thick or thin gage metals.

Data Sheet on Expansion

THE selection of a suitable material for equipment subject to wide variations of temperature—such as internal combustion engines—requires a knowledge of the rates of expansion of metals at the designing engineer's disposal. Cast iron has not in the past been considered commercially as a material which offers a range of expansivity to meet such conditions. In the past, expansion problems of industry have been met by the use of Invar-type alloys and like metals.

The International Nickel Company, 67 Wall Street, New York, N.Y., has recently published the results of research into this subject which will prove of considerable value to the designing engineer. Copies of this illustrated data sheet, "Thermal Expansion Characteristics of Some Nickel Cast Irons," are available upon request.



Small Cranes Carry Long Booms

TWO SPECIAL cranes were recently completed by the Harnischfeger Corporation of Milwaukee. It is reported that these two machines have special booms of light, welded tube construction, double the standard 25-ft length and made with two boom inserts of 10 and 15 ft. Other special equipment includes high gantry, and telescopic boom stops.

Although the rated lifting capacity of the machines is 1,800 lbs at 20-foot radius, actual tests proved that the machines would lift 2,150 lbs at this distance, travel and swing them at reasonable speed with ample stability.

Construction view of the Tribune Building, Montevideo, Uruguay—DESIGNED FOR CONTINUITY

Continuity
of
CONCRETE
BUILDING FRAMES
means strength,
rigidity and economy

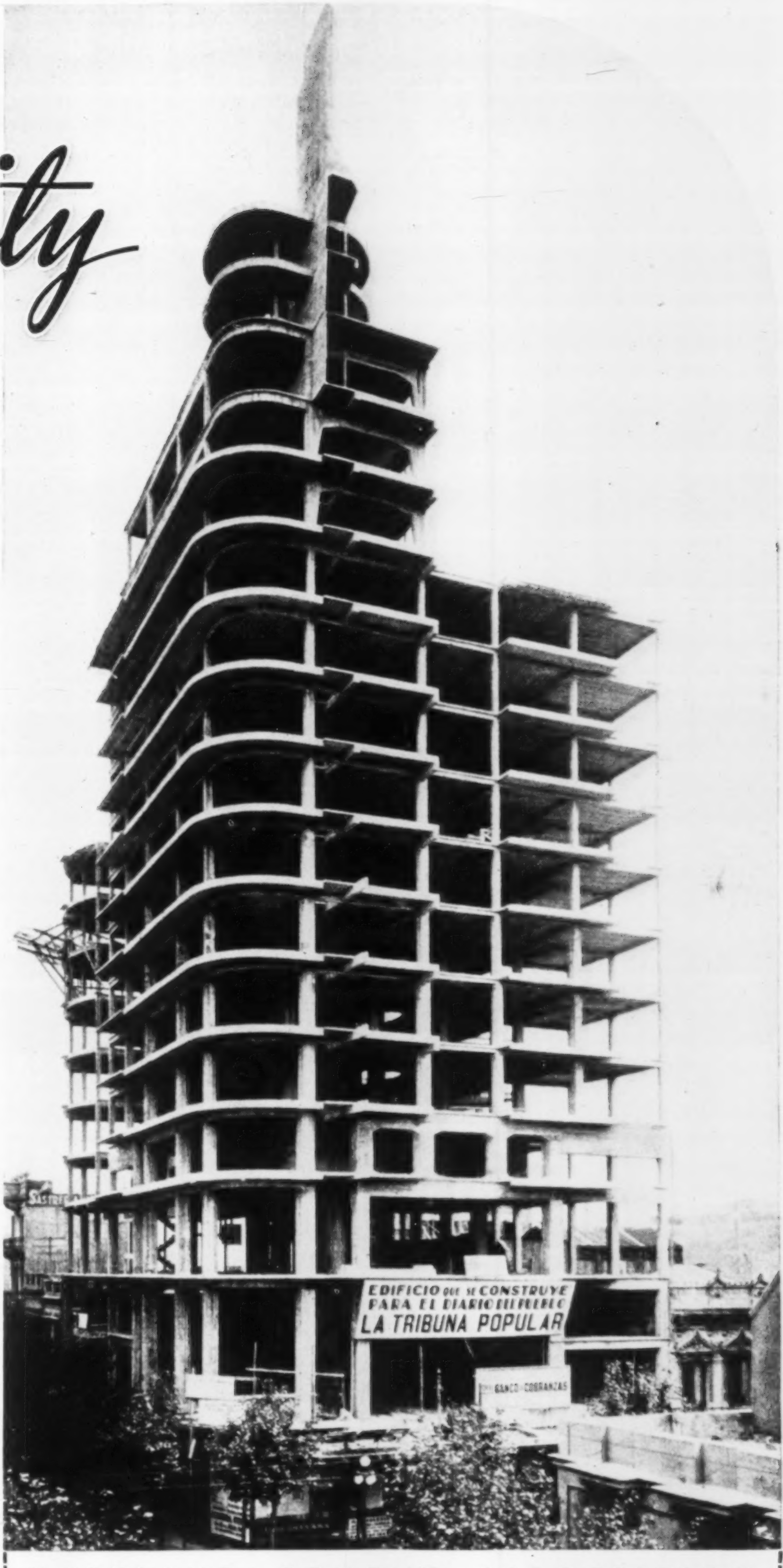
THE inherent continuity of reinforced concrete construction gives the designing engineer one of his greatest opportunities for efficient design.

Rigid concrete frame connections give greater strength to carry vertical loads, greater resistance to wind forces and earthquake shocks.

And with reinforced concrete this strength and rigidity are obtained *without extra cost*.

Advanced methods have been developed for the design of continuous building frames which reduce what was once a complex engineering problem to one that is easily and quickly solved in a simple, practical manner.

Methods of analysis have been studied, correlated and presented in a new booklet, "*Continuity in Concrete Building Frames*." It includes numerical examples that thoroughly illustrate the analysis of vertical loads and wind pressures. Send the coupon for your free copy.



PORTLAND CEMENT ASSOCIATION
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City.. *State*..................

Le Tourneau Announces Cradledump Buggy

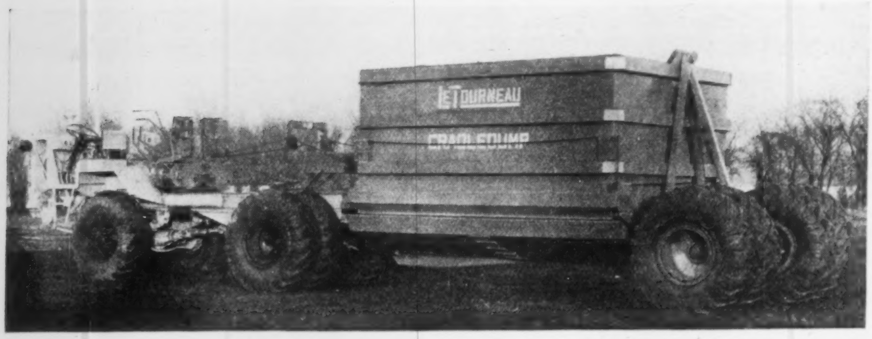
THE CRADLEDUMP BUGGY, a new earth-moving carrier of 30-yd capacity, built for use with large-size tractors, and without the front axle, for use with trucks as a semi-trailer, has just been announced by R. G. Le Tourneau, Inc., of Peoria, Ill., and Stockton, Calif. The Hug model 100 Tractor Truck has been developed to handle this new Le Tourneau job. The combination of Cradledump trailer and Tractor Truck was specially designed by Le Tourneau, and Hug for the use of contractors desiring a powerful, high-speed carrier for long hauls.

The Cradledump Buggy has a water-level capacity of 30 cu yd and approximately 35 yd loose measure. Its inside body dimensions are 9 by 13 ft, amply big enough to make careful spotting of shovel buckets unnecessary when loading. Unloading is controlled from the tractor driver's seat by means of half-inch steel cables and sheaves connected to a standard two-drum power control unit mounted at the rear of the tractor motor. The body is pivoted at the top and expels its load by moving in a cradle-like arc to the side, forcing the entire load off the buggy as it moves. One line from the power control unit controls this dumping process, the other line returns the body to the loading position and holds it.

Like all Le Tourneau equipment, the Le Tourneau Cradledump Buggy is stoutly constructed of special alloy steel, electrically arc welded. The body itself consists of four sides well-reinforced to prevent binding or twisting. The bottom is separate from the top and stationary. It serves the dual purpose of a base for the sides and a frame for the running gear and is ruggedly built to withstand the terrific shocks of loading earth and rock from shovels. It has a double bottom consisting of two layers of alloy steel with a 6-in. layer of wood in between. The two steel layers are tied together at 27-in. intervals by cross ribs of steel. A heavy, reinforced truss runs the full length of the bottom.

Both the Cradledump Buggy and Hug Model 100 Tractor Truck are mounted on 18.00 by 24 tires, with 6 tires on the Truck and 4 on the Cradledump trailer. This gives a ground contact for the combination of 6,000 sq in. When used with tractors, the Cradledump Buggy is equipped with 8 of these tires, mounted front and rear in dual sets.

The Hug Model 100 Tractor Truck, which is built especially for use with the Cradledump Buggy, has a four-wheel drive and is powered by a Caterpillar Diesel Model D13000 engine. In tests this four-wheel drive has developed a remarkable amount of traction in soft mud. It is capable of a top speed of 29 miles per hr in overdrive and has a low speed of $1^1/_2$ miles per hr. The draw-bar pull at this lowest speed is 28,837 ft-lb.



Crane Co. Establishes New Divisions

IN ORDER to maintain and enhance progress in its diversified fields, and to foster the invention of new products, Crane Co. has established a Division of Research and Development. The importance and volume of research and development work warrants the constant full-time effort of a group of technical specialists. They will devote their entire time to a study of the requirements of the trade, with freedom to pursue the research designing and experimental work necessary to improve existing products, and to develop original designs and materials for new products. The research and development work formerly handled by various departments and subsidiaries will be expanded and centralized in the new Division, which will be responsible directly to the President, with the Vice-President of Manufacture and the Vice-President of Sales acting in a coordinating capacity.

The character of work covered by the new Division is indicated by some of the units which it comprises. There will be one for field research, separate units for research and development on industrial products, plumbing products, and heating products. Also, there will be separate laboratories for research testing and metallurgical research. One unit will be devoted to standardization programs, and another to patents and inventions.

Announcement is also made of the creation of a new Product Engineering Department at the Chicago works under the jurisdiction of the Vice-President of Manufacture. There will be close association between the Division of Research and Development and the Product Engineering Department, so that the latter may place in proper production the products or improvements in existing products developed by the Division of Research and Development.

Inland's New Booklet

THE Inland Steel Company, Chicago, has just published a new edition of its handy booklet, "Sizes We Roll." It includes complete size data on all sheets, strip, bars, plates, structurals, and semi-finished steel produced by Inland, and also several reference tables useful in ordering steel. It is a 64-page book, of a shape and size convenient for use both in the office and out on the job.

Nickel-Clad Steel Catalog

THE Lukens Steel Company announces the publication of a new 24-page catalog on Lukens Nickel-Clad Steel. This catalog illustrates and completely describes a large number of the applications of Nickel-Clad Steel.

New P & H Shovel

The Harnischfeger Corporation of Milwaukee, Wis., announce an entirely new excavator, the Model 765, which is reported to embody the most advanced engineering ideas to speed up the digging cycle and increase production in a machine of 2-cu yd capacity.

Portland Cement Stucco

A NEW edition of this illustrated booklet is announced by the Portland Cement Association, Chicago, Ill. It contains a full set of specifications for the proper application of portlant cement stucco on new and old buildings and also complete instructions on how to produce a variety of stucco textures. Copies may be obtained upon request.

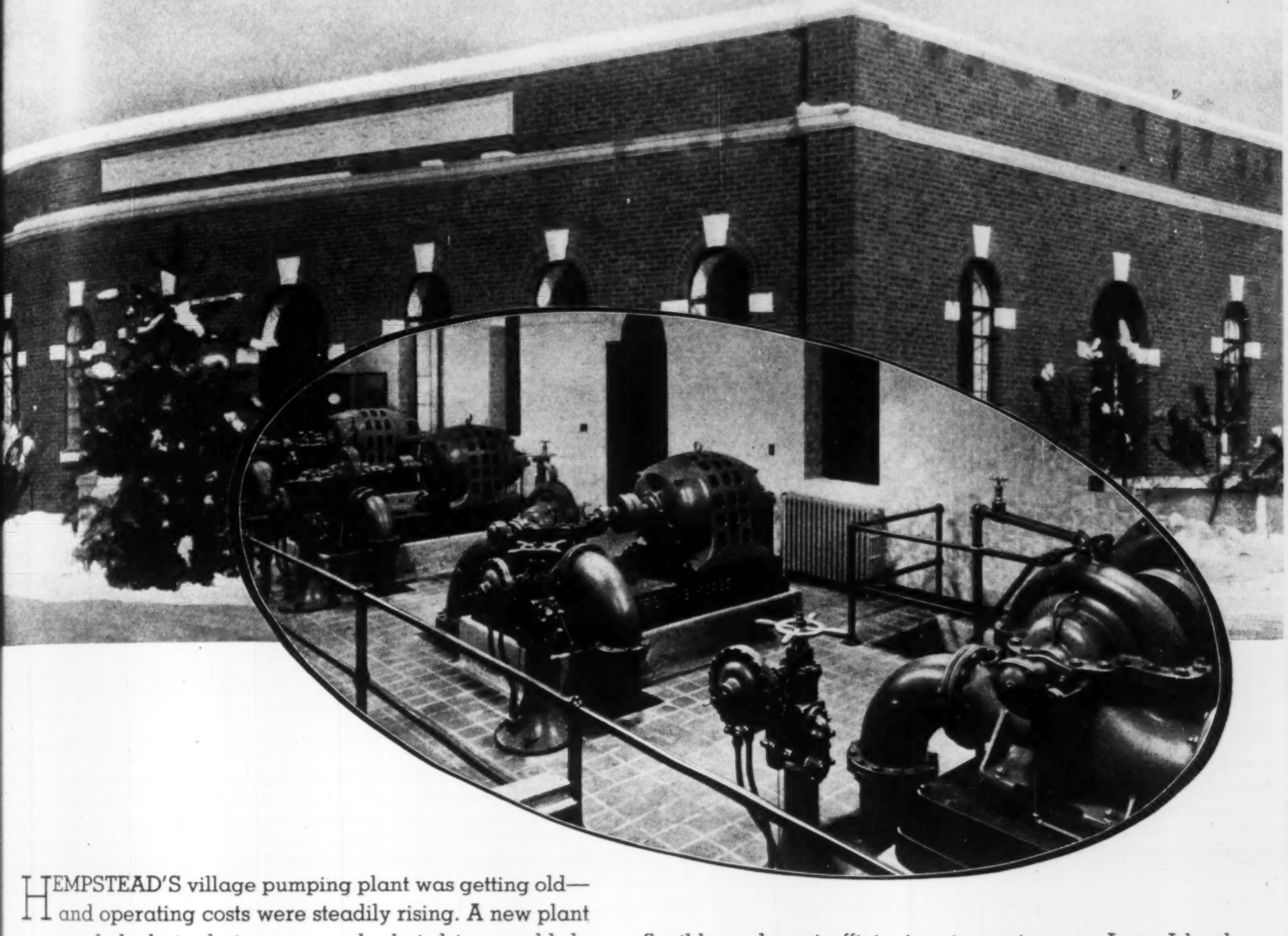
Procedure Handbook for Arc Welding

THE Lincoln Electric Company announces the publication of its new "Procedure Handbook of Arc Welding Design and Practice," containing 586 pages, $5^3/_4$ by 9 in., with semi-flexible binding.

The subjects treated in the 8 parts of this new handbook are welding methods and equipment; technic of welding; procedures, speeds, and costs for welding mild steel; structure and properties of weld metal; weldability of metals; designing for arc-welded steel construction of machinery; designing for arc-welded structures; typical applications of arc-welding in manufacturing, construction and maintenance.

Copies may be secured at the price of $1.50 postpaid from the Lincoln Electric Company, Cleveland, Ohio.

HEMPSTEAD, LONG ISLAND, CHOSE
F-M Motor-Driven Centrifugals
FOR ITS MUNICIPAL PLANT



HEMPSTEAD'S village pumping plant was getting old—and operating costs were steadily rising. A new plant was needed—but what pumps and what drive would do the best job?

They turned to Fairbanks-Morse.

F-M deep well turbines were installed to deliver the water supply through spray nozzles into an aeration reservoir. F-M motor-driven centrifugals were chosen to deliver water from the reservoir direct to the mains under a 185-foot head.

The new pumping plant is not only one of the most flexible and most efficient water systems on Long Island—but it has provided real savings for the citizens of Hempstead.

Handling water for municipalities and industry is an important Fairbanks-Morse service. Our engineers are always available to help plan any type of job. For full information, address Department F541, Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill. 34 branches at your service throughout the United States.

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Selected items from the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file in The Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own files, from your local library, or direct from the publisher. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page, plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

Arch. Eisenbeton und Stahl im Grossbrueckenbau, F. Glaser. *Zeit des Oesterreichischen Ingenieur- u. Architekten-Vereines,* vol. 86, nos. 39 and 40, Oct. 5, 1934, pp. 230–234. Mathematical review of principles of design of long-span, concrete-arch, and steel-arch bridges; relative economy of these two types.

Concrete, Facing. Brick Facing Applied to New Hampshire Highway Bridge, E. F. Gallagher. *Eng. News-Rec.,* vol. 115, no. 24, Dec. 12, 1935, p. 813. Construction of brick veneer finish of rigid-frame concrete bridge, with 39-ft span, near Epping, N.H.

Germany. Stromuebergaenge im Odergebiet eine verkehrsgeographische Betrachtung, Moehlmann. *Zentralblatt der Bauverwaltung,* vol. 54, no. 46, Nov. 14, 1934, pp. 709–720. Study of 107 bridges of various sizes and types of construction crossing Oder River and its tributaries, also data on 116 ferries.

Steel. Many Influences Affect Trend of Bridge Design and Construction, C. E. Webb. *Ry. Age,* vol. 99, no. 21, Nov. 23, 1935, pp. 658–661. Review of advances in steel-bridge practices resulting from better materials, improved methods, and modern equipment. Before Am. Ry. Bridge and Bldg. Assn.

Steel, Germany. 15 Jahre Materialentwicklung im Stahlbau, Bohny. *Bauingenieur,* vol. 16, nos. 5/6, Feb. 1, 1935, pp. 45–50. Review of 15 years of progress in development of steel and steel alloys for bridge construction; progress in structural steel welding; steel for cables of suspension bridges.

Steel, Welding. Welded Bridge and Structural Work, A. Doernen. *Welding J.,* vol. 32, no. 385, Oct. 1935, pp. 304–305. Progress of welding in structural work and its advantages from point of view of construction, economy, and esthetics. Before Inst. Welding.

Steel Arch, Sweden. Die Maelarseebruecke ueber den Riddarfjarden in Stockholm. *Zentralblatt der Bauverwaltung,* vol. 54, no. 49, Dec. 5, 1934, pp. 757–759. Features of recently completed Maelarsee steel-arch bridge at Stockholm, Sweden, consisting of two spans, 168 m and 204 m long, with rise of 20.3 m and 24.5 m; method of construction.

Steel Truss, Davenport, Iowa. Building Davenport Bridge Across Mississippi. *Eng. News-Rec.,* vol. 115, no. 25, Dec. 19, 1935, pp. 837–841. Structure consisting of twisted-wire-strand cable suspension bridge with 740-ft main span and two 3-span continuous-truss units supported on seven piers, each 222 ft long; total cost, $1,500,000; foundations; cable wrapping; cantilever erection of continuous-truss spans using falsework bent of six steel H-piles equipped with jacks to lift span for landing on pier ahead.

Steel Truss, Georgia. New 1,218-Foot Bridge Erected by Georgia at Old State Capitol. *Contractors & Engrs. Monthly,* vol. 30, no. 3, Mar. 1935, pp. 2, 13, and 24. Construction of highway bridge 30 ft wide over Oconee River at Milledgeville, Ga., consisting of 16 spans of 47 ft each at west end, two river truss spans of 163 ft each, and three 47-ft spans at east end.

Suspension, San Francisco–Oakland Bay. San Francisco-Oakland Bay Bridge, G. L. Beaver, R. F. Emerson and A. A. Merrill. *Gen. Elec. Rev.,* vol. 38, no. 12, Dec. 1935, pp. 558–566. General statistics relating to project and structure; notes on foundations and construction; West and East Crossings and island tunnel; superstructure; cables and cable spinning operations; equipment and manipulation; control circuits.

Wooden, Fire Prevention. Fire Walls Prove Ineffective in Saving Long Trestle, S. B. Slack. *Eng. News-Rec.,* vol. 115, no. 23, Dec. 5, 1935, p. 771. Fire destroyed 1,645-ft south approach trestle to highway bridge over the Ocmulgee River at Lumber City, Ga.; firebreaks provided in trestle at intervals of about 200 ft proved entirely ineffective.

CITY AND REGIONAL PLANNING

Great Britain, Highway Provisions. Town and Country Planning Act, 1932, A. H. Prince. *Surveyor,* vol. 87, no. 2250, Mar. 8, 1935, pp. 339–340. Highway provisions in model clauses; reservation of lands; streets and building lines.

Great Britain, Proposed Board. Garden Cities and Satellite Towns. *Surveyor,* vol. 87, no. 2255, Apr. 12, 1935, pp. 483–484. Abstract of report of Departmental Committee of Ministry of Health of Great Britain, proposing National Planning Board; duties of proposed board; effects of haphazard building; planning and replanning.

Stockholm. Staedtebauliche Probleme und Umgestaltungen in Stockholm—I, S. Vinberg and C. Semler. *Bauingenieur,* vol. 16, nos. 1/2, and 3/4, Jan. 4, 1935, pp. 1–9, and Jan. 18, pp. 36–37. Review of recent changes in Stockholm city plan and means of communication; improvements in waterways, railways, and highways, including construction of great bridges and tunnels.

Street Traffic Control. Kraftwagenmasse und Parkmasse, A. Leipold. *Verkehrstechnik,* vol. 16, no. 17, Sept. 5, 1935, pp. 441–445. Automobiles and parking space in cities; discussion of parking possibilities on outskirts of city; critical analysis of existing parking possibilities in German cities; suggestions for layout of parking space and for minimum width of street with parking space; examples.

United States. State Planning. Nat. Resources Board, June 1935. Washington, U. S. Gov. Printing Office, 1935, 310 pp., diagrs., tables. 75 cents (paper cover). Review of development of state planning progress in United States by 45 state planning organizations; activities of state planning boards; land planning; water; power; minerals; transport; public improvement programs and public buildings; social and economic trends; governmental relationships. Bibliography.

CONCRETE

Construction, Vibrating. Structural Properties of Vibrated Concrete, P. Anderson. *Eng. News-Rec.,* vol. 115, no. 20, Nov. 14, 1935, pp. 676–677. University of Minnesota tests demonstrate possible savings in cement and reduction in concrete shrinkage by use of vibration as aid to placing.

Design. Plain Concrete in Tension, H. Foster. *Surveyor,* vol. 87, no. 2243, Jan. 18, 1935, pp. 57–59. Theoretical study of value of unreinforced concrete in resisting tensile stresses with special reference to underwater structures; numerical examples.

Mixing. Beziehungen zwischen Moertelfestigkeiten des Zementes und Druckfestigkeiten des plastischen Betons, A. F. Roscher-Lund. *Zement,* vol. 24, nos. 6 and 7, Feb. 7, 1935, pp. 83–87, and Feb. 15, pp. 97–101. Relations between strength of cement mortar and compressive strength of plastic concrete mixes; 7 methods compared on basis of formula developed by author; it is concluded that ideal requirements are most nearly attained by method in which mix of plastic consistence containing cement, fine sand, and standard sand in proportion 1:1:2 is used.

Sand, Storage. Canvas Hoods Over Sand Piles Keep Water Content Uniform. *Eng. News-Rec.,* vol. 115, no. 24, Dec. 12, 1935, p. 823. To protect sand stockpiles from weather, canvas hoods or "skirts" have been employed with success on sand to be used in concrete on Bonneville project.

CONSTRUCTION INDUSTRY

Building Codes, Great Britain. Notes on Building Regulations, F. Rings. *Concrete & Constr. Eng.,* vol. 30, no. 2, Feb. 1935, pp. 120–123. Discussion of British building codes referring to strength of core concrete; suggestions for improving reinforced concrete regulations; administration of Building Act.

DAMS

Boulder Dam Project. Mineral Resources and Possible Industrial Development in Region Surrounding Boulder Dam. *U. S. Bur. Reclamation,* Nov. 1934, 44 pp., supp. plates in pocket. Reports on: Field Study of Mineral Resources in Region Tributary to Boulder Dam, by U. S. Geological Survey; Cost of Electrical Energy at Boulder Dam and Delivered at Points 100 and 200 Miles Distant, L. N. McClellan; Economic Factors to Be Considered in Development of Mineral Industries Tributary to Boulder Dam, C. K. Leith and H. N. Eavenson.

Concrete Gravity, Pickwick Landing, Tenn. Third TVA Dam Under Way at Pickwick Landing. *Eng. News-Rec.,* vol. 115, no. 19, Nov. 7, 1935, pp. 636–639. Features of Tennessee Valley Authority dam on Tennessee River consisting of hydraulic fill section about 50 ft high, plus concrete-gravity spillway section, about 43 ft high, surmounted with twenty-four 40 by 40-ft gates; total length, 7,667 ft; dam site conditions; stream flow at site; embankment design; concreting plants.

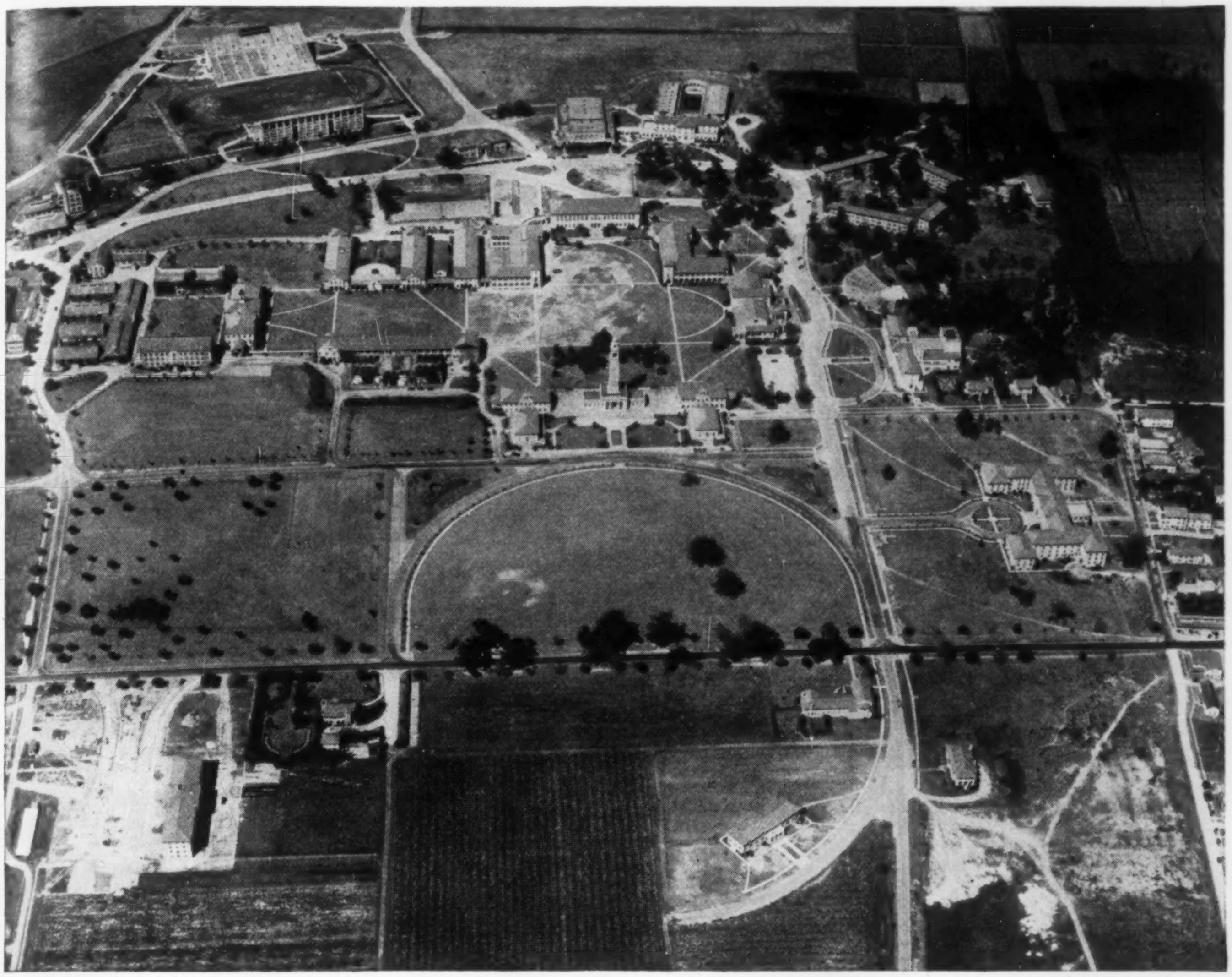
Concrete Grouting. Thousands of Holes Grouted Under Norris Dam. *Eng. News-Rce.,* vol. 115, no. 21, Nov. 21, 1925, pp. 699–701. Grouting procedure in foundation of overflow concrete dam 285 ft high; grouting holes up to $5^1/_2$ in. in diameter, spaced 10 ft apart, reach depth down to 100 ft; details of periscope used to examine rock conditions through large core-drill holes; preparation of measures to be taken for prevention of important leakage from reservoir when it begins to fill.

Dredges. Fort Peck Dredges Designed for High Capacity on Long Pipe Lines. *Eng. News-Rec.,* vol. 115, no. 24, Dec. 12, 1935, pp. 810–813. Pumping plant for placement of huge earthfill, built and assembled at dam, consists of four identical units of one dredge, one floating booster, and one rail-mounted booster, all equipped with 28-in. electric-drive pumps; details of two 28-in. pumps, set in tandem at same elevation, and of basket-type cutters, 7 ft in diameter.

Movable. Modern Types of Movable Dams. *Engineer,* vol. 160, no. 4165, Nov. 8, 1935, pp. 471–473. Review of reports on movable dams from 11 different countries; scope of these papers is limited generally to particulars of maximum dimensions attained in construction of various types, recent developments in design, and means of reducing to minimum undermining of weir structures.

Seepage. Seepage of Water Through Dams with Vertical Faces, M. Muskat. *Physics,* vol. 6, no. 12, Dec. 1935, pp. 402–415. Application of method of hodographs, developed by Hamel for analysis of ground-water flow systems containing free surfaces, to six cases of seepage of water through dams in which ratio of inflow fluid head to width of dam at base varied from 2.04 to 1.08; heights of surfaces of seepage and total fluxes calculated for all six cases.

COSTS TAKE A 'NOSE-DIVE'



"NINETEEN days from the time we started to lay this building out, we had poured the last of 1500 cu. yds. of concrete," says George Caldwell, Superintendent of Construction at Louisiana State University—referring to Highland Hall, dormitory for women, one of a number of structures on the L. S. U. campus (air view above) built with 'Incor'. Continuing, Mr. Caldwell states:

"For this 4-story building, we had to buy form lumber for only 2 floors. We poured a floor every other day, re-using first and second floor forms for third floor and roof slab. That saved 35,000′ of form lumber, at about 12¢ a ft. With ordinary Portland cement, the job could not have been completed on time. By using 'Incor' we saved 30 days—and $4200."

Because 'Incor' is self-supporting in one-fifth the usual time, forms are stripped in 24 to 48 hours—ready for re-use. One form-set does the work of two or three—saving 50% to 70% on form costs.

Speed of erection no longer depends upon form multiplicity. Instead, it is based upon the contractor's ability to organize labor and equipment. Figure 'Incor'* against ordinary Portland cement on your next job and see the difference. Made and sold by producers of Lone Star Cement, subsidiaries of International Cement Corporation, New York; also sold by other leading cement manufacturers.

*Reg. U. S. Pat. Off.

'INCOR' 24-Hour Cement

Spillways. New Spillway Permits Use of Old Earth Dam. *Eng. News-Rec.*, vol. 115, no. 23, Dec. 5, 1935, pp. 786–787. Addition of steep chute ending in stilling pool to Continental earth dam on Clear Creek, Colo., allows dam to be placed in service after 6 years of disuse; capacity of spillway is 1,500 cu ft per sec; drop is about 100 ft; cost, $30,000.

FLOOD CONTROL

China. Hupeh Flood of 1935, G. G. Stroebe. *Assn. Chinese & Am. Engrs.—J.*, vol. 16, no. 6, Nov.-Dec. 1935, pp. 310–318, 4 supp. plates. High water levels on Yangtze and Han rivers; discharge measurements of Yangtze and Han; flood on Han; dike breaks; remedies; detention basins. Before Hankow Rotary Club. (In English.)

Discharge. Intensities of Flood Discharges, G. B. Williams. *Engineer*, vol. 160, no. 4167, Nov. 22, 1935, pp. 532–534. Provision for floods in engineering works; possibility and probability of abnormal rain storms; ratio of probable intensity of discharge to probable interval between occurrence of flood; classification of floods; factors affecting rates of flood discharge; formulas for rates of flood flow; floods in British Isles and in the United States; rainfall and floods in India.

Levees, Construction. Neues Unterwasserzementeinpressverfahren zur Herstellung von Uferdeckwerken, A. Stalf. *Zement*, vol. 24, nos. 17 and 18, Apr. 25, 1935, pp. 262–265, and May 2, pp. 275–280. New patented process for injecting cement into subaqueous sand and gravel transported by streams and sea currents for purpose of forming revetments for shore-protection works.

FOUNDATIONS

Bearing Pressure. Determination of Foundation Pressures on Clay, M. A. Ravenor. *Engineering*, vol. 140, nos. 3648 and 3649, Dec. 13, 1935, pp. 642–643, and Dec. 20, pp. 655–656. Presentation and applications of equation for relation of pressure and settlement of structures; examples taken from practice serve to illustrate application of principles.

Caissons, Steel, Pneumatic. Caisson-Sinking at Plantation Quay, Glasgow, T. J. S. Mallagh. *Instn. Civ. Engrs.—Selected Eng. Papers*, no. 180, 1935, 24 pp. Construction and sinking of pneumatic caissons which had both permanent and temporary steelwork; permanent caissons were only 10 ft 6 in. in height, but temporary strakes were used to increase this height to 37 ft; setting and retaining caisson permanently on bottom; pneumatic arrangements; blasting; setting caisson to final levels; bottom seal; caisson disease.

Piles, Concrete, Driving. Behavior of Reinforced Concrete Piles During Driving, W. H. Glanville, G. Grime, and W. W. Davies. *Engineering*, vol. 140, no. 3645, Nov. 22, 1935, pp. 563–564. Account of investigation into behavior of piles carried out at Building Research Station; main problem was to devise methods of estimating amount of driving that pile would stand without damage; results and conclusions.

Settlement. Settlement of Footings in Alluvial Soil, F. J. Converse. *Eng. News-Rec.*, vol. 115, no. 22, Nov. 28, 1935, pp. 746–747. Bearing tests on Los Angeles basin soils made during reconstruction following earthquake indicating variations with size of footing, moisture content, and underlying strata; method of testing; soil profile and compression curves determined by bearing tests on soils in Los Angeles alluvial basin.

Testing. Fuenfzehn Jahre Baugrundforschung, K. von Terzaghi. *Bauingenieur*, vol. 16, nos. 3/4, Jan. 18, 1935, pp. 25–31. Review of 15 years of progress in study and testing of foundations in Europe and America. Bibliography.

HYDRAULIC ENGINEERING

Laboratories, Outdoor. Outdoor Types of Hydraulic Laboratories and Their Significance in Study of Summer and Winter Regimens of Streams, V. E. Timonov. *Izvestiya Nauchno-Issledovatelskovo Instituta Hydrotechniki*, no. 14, 1934, pp. 81–190. Historical review, descriptions, and practice of outdoor hydraulic laboratories in France, Germany, Great Britain, Italy, Holland, Czechoslovakia, United States, and U.S.S.R., with special reference to ice engineering studies. Bibliography. (In Russian, with English abstract, pp. 188–190.)

Research. New Organization Established to Correlate Hydraulic Research, H. N. Eaton. *Eng. News-Rec.*, vol. 115, no. 25, Dec. 19, 1935, pp. 855–856. Organization of International Association for Research on Hydraulic Structures, founded at Brussels in September 1935, on occasion of meetings of Permanent International Association of Navigation Congresses, to promote international cooperation in hydraulic research and to facilitate interchange of results obtained.

INLAND WATERWAYS

Germany. Die Arbeiten der Reichswasserstrassenverwaltung im Jahre 1934, Gaehrs. *Bautechnik*, vol. 13, nos. 1, 4, 9, 13, 17, 19, and 21, Jan. 4, 1935, pp. 2–6; Jan. 25, pp. 49–53; Mar. 1, pp. 105–108; Mar. 22, pp. 176–179; Apr. 19, pp. 213–217; May 3, pp. 245–247; and May 17, pp. 261–264. Review of 1934 activities of German Waterways Administration; detailing improvements of ports and rivers, construction of new canals, canal locks, canal boat lifts, shore protection works, etc.

LAND RECLAMATION AND DRAINAGE

France. Les grands travaux de l'industrie privée: L'île Seguin, R. Clément-Cuzin. *Travaux*, vol. 18, no. 19, July 1934, pp. 275–284. Reclamation of Island of Seguin near Paris, France, by construction of high-level suspension bridge and deposition of 600,000 cu m of fill; construction of two groups of industrial and office buildings, occupying area of about 150,000 sq m, for Renault automobile works.

MATERIALS TESTING

Road Materials, Specifications. Road Materials. *Am. Soc. Testing Matls.—Tentative Standards* (issued annually), 1935, pp. 782–875 and 1444. Tentative specifications, methods of testing, and definition.

PORTS AND MARITIME STRUCTURES

Baltimore. Port of Baltimore, G. H. Pouder. *Naut. Gaz.*, vol. 125, no. 24, Nov. 23, 1935, pp. 15, 23, and 37. Statistical data; imports; recent physical improvements; facilities; development of outstanding importance was definite beginning, in September 1935, of work on proposed deep-draft Chesapeake and Delaware Canal.

Bordeaux, France. Le port de Bordeaux et ses annexes. Travaux récemment exécutés ou en cours d'exécution au Verdon, en Gironde et au Bec d'Ambès, Fischer. *Génie Civil*, vol. 107, no. 1, July 6, 1935, pp. 1–9. Landing facilities of Bordeaux and other ports of Gironde estuary; equipment for embarking and disembarking of cargo and passengers; details of balanced pneumatic fenders; petroleum products port of Ambès; report on dredging operations.

Cartagena, Colombia. New Deep-Water Port at Cartagena, Colombia, R. H. Cady. *Eng. News-Rec.*, vol. 115, no. 21, Nov. 21, 1935, pp. 710–713. Recent construction of bulkhead wharf and piers of concrete and dredged basin for ocean and river steamships; bulkhead wharf 1,065 by 33 ft, is located so as to balance dredging and fill; selection of site; two piers, 130 ft wide by 600 ft long, and 400 ft apart were constructed at angle of about 60 deg with wharf; cargo-handling equipment; casting and driving piles.

Three Rivers, Quebec. Port of Three Rivers. *Naut. Gaz.*, vol. 125, no. 22, Oct. 26, 1935, pp. 5–6. Port situated on north shore of St. Lawrence River is approximately half-way between Montreal and Quebec; port features, characteristics, and developments.

ROADS AND STREETS

Asphalt. Asphalt Road Surfacing, A. C. Hughes. *Surveyor*, vol. 87, no. 2266, June 28, 1935, pp. 813–815. Trend of design as exemplified by recent British Standard Specifications; variations in mixtures; compliance with specifications; changes in material; single-coat mixtures; bitumen requirements; cold asphalt specifications; proportions of materials; value of specifications. Before Instn. Mun. & County Engrs.

China. Some Notes on Highway Construction in Provinces of Kiangsu, Chekiang, and Anhwei, W. H. F. Woo. *Assn. Chinese & Am. Engrs.—J.*, vol. 16, nos. 5 and 6, September-October 1935, pp. 253–260, 1 supp. plate, and November-December, pp. 327–334, 2 supp. plates. September-October: Existing practices in different phases of highway construction; possible improvements in practices and methods; alignment; roadbed construction. November-December: Surfacing; structures. (In English.)

Culverts, Construction. Road Intersection Presents Difficult Culvert Problem, W. D. Colby. *Eng. & Contract Rec.*, vol. 49, no. 8, Feb. 20, 1935, pp. 132–134. Unusual situation in Kent County, Ontario, successfully solved by use of 100-ft multi-plate structure with span of 18 ft 9 in. and rise of 6 ft 3 in.

Curves. Notes on Suggested Standard Transition Curve for Roads, H. J. E. Hone. *Surveyor*, vol. 87, nos. 2262 and 2266, May 31, 1935, pp. 671–673, and June 28, (discussion) pp. 803–804. Diagram of complete standard transition curve showing values of angles and lengths of chords and offsets, etc.; data and setting-out details for transition to all curves of radii 4,000 ft or less; typical examples of proposed standard transition curve types; celluloid curve graduated to required superelevation.

Highway Engineering, United States. Highway Officials Stress Safety as Major Problem. *Eng. News-Rec.*, vol. 115, no. 26, Dec. 26, 1935, pp. 891–894. Proceedings of 1935 annual meeting of American Assn. of State Highway Officials, including abstracts of papers on lighting of roads, K. M. Reid; grade-crossing elimination, E. C. Lawton; and safety requirements, S. J. Williams.

Highway Systems, Long Island. Brooklyn's New Entrance to Long Island Parkways. *Eng. News-Rec.*, vol. 115, no. 26, Dec. 26, 1935, pp. 871–874. Description of 5-mile Interborough Parkway link with Grand Central Parkway terminating in 4-bridge grade-separation layout, superimposed on complicated pattern of Brooklyn streets.

Low Cost. Design and Construction of Low-Cost Road Surfaces—I, C. A. Hogentogler and C. M. Johnston. *Can. Engr.*, vol. 68, no. 1, Jan. 1, 1935, pp. 7–11. Study of soils in relation to stability of pavements; internal friction of cohesionless materials; influence of internal friction and cohesion upon stability; proper grading and control of moisture content. Before Can. Good Roads Assn.

Maintenance and Repair. Keeping Roads Open for Traffic in Winter, A. K. Hay. *Can. Engr.*, vol. 68, no. 9, Feb. 26, 1935, pp. 80–81, (discussion) pp. 81–82. Methods employed in Ottawa district for clearing snow from highways; snow fencing; motor trucks used for plowing; cost of snow removal.

SEWERAGE AND SEWAGE DISPOSAL

Analysis. Beitrag zur Bestimmung der absetzbaren Stoffe in Abwaessern, J. Lesenyei. *Gesundheits-Ingenieur*, vol. 58, no. 4, Jan. 26, 1935, pp. 50–52. Report from Budapest Sewage Laboratory on apparatus for determination of settling sewage solids.

Chemical Process. Chemical-Mechanical Treatment of Sewage, L. P. Booz. *Am. City*, vol. 50, no. 11, Nov. 1935, pp. 65 and 67. Features of new chemical coagulation plant at sewage disposal works of Perth Amboy, N.J., to cost $900,000.

Dairies, Waste Disposal. Trade-Waste Treatment Plant at Beltsville Research Center, Md. *Eng. News-Rec.*, vol. 115, no. 23, Dec. 5, 1935, pp. 787–788. Disposal plant at U. S. government agricultural station designed to handle large quantities of dairy and abattoir wastes; chemical precipitation will be used as adjunct to purification process.

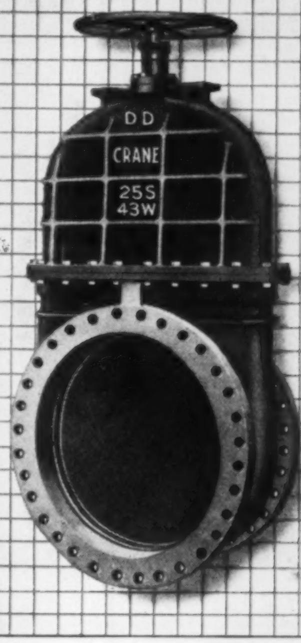
Industrial Wastes. Recent Trade Waste Treatment Methods, W. Rudolfs. *Sewage Works J.*, vol. 7, no. 4, July 1935, pp. 713–726. Treatment of liquid wastes from industrial plants as presented in literature during years 1932–1934; discussion of patents; treatment of wastes from tanneries, textile mills, paper and pulp plants, beet sugar mills, corn starch and distillery plants, slaughter houses, etc.; elimination of pickling liquors and gas house liquors, also of dairy wastes. Bibliography.

Odor Control. Elimination of Smells from Sewers and Sewage Disposal Works, H. Wilson. *Surveyor*, vol. 87, no. 2246, Feb. 8, 1935, pp. 223–224. Abstract of paper on practice of City of Johannesburg, South Africa; sewage treatment in sewers; enclosed plant deodorization; ozonization of foul air.

Palestine. Sewage Treatment in Holy Land, I. W. Mendelsohn. *Mun. Sanitation*, vol. 6, no. 1, Jan. 1935, pp. 8–9, and 20. Advances made in past decade; plans studied by government health department; temporary plant erected at Wady Joz; connections trebled in 8 years; Haifa and Jaffa sewerage systems; Tiberias and Tel Aviv sewerage systems.

Plants, Cedar Rapids, Iowa. Domestic and Packing-House Wastes Treated Jointly at Cedar Rapids. *Eng. News-Rec.*, vol. 115, no. 24, Dec. 12, 1935, pp. 803–807. Description of new mechanized type of sewage disposal plant for population of 60,000, with industrial load equal to domestic; eight circular trickling filters, largest yet built, are served by two straight-line final clarifiers with novel sludge-flushing arrangement operated by time clock; gas-engine generator set; packing-house pre-treatment plant; cost, $750,000.

Plants, Durham, N.C. Features of New Northside Sewage Treatment Works of Durham, N.C., W. M. Piatt. *Water Works & Sewerage*, vol. 82, no. 10, Oct. 1935, pp. 337–343. Development of North Side sewage treatment project with Public Works Administration assistance; description of new plant serving population of 30,000; screens and comminutors; settling tanks; sludge control; gas holder and gas engines; heat recovery; new principle in air diffusion; blowers; sludge and effluent pumping.



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VALVES, FITTINGS, FABRICATED PIPE, PUMPS, HEATING AND PLUMBING MATERIAL

Plants, Federated Malay Peninsula. Water Supply and Sewage Disposal at Singapore, Straits Settlements, I. W. Mendelsohn. *Water Works & Sewerage*, vol. 82, no. 11, Nov. 1935, pp. 371–374. System serving 500,000 population; rapid sand filters and pumping stations; analyses of raw and filtered waters, crude sewage and effluents; experimental work; comparative results with trickling filters from applied Imhoff and bio-flocculation tank effluents; separate digestion of night soil; results of bio-flocculation unit.

Plants, Operation, Germany. Betrachtungen zu den Betriebsergebnissen der Muenchener Abwasserklaeranlage im Betriebsjahr 1933/34, E. Stecher. *Bautechnik*, vol. 13, nos. 10 and 15, Mar. 8, 1935, pp. 113–117, and Apr. 5, pp. 200–204. Discussion of operating experience of sewage disposal works of City of Munich, Germany, serving population of 738,000; sludge disposal and gas recovery; cost data.

Plants, South Africa. South African Sewage Disposal Scheme, H. L. Reitz. *Engineer*, vol. 160, no. 4162, Oct. 18, 1935, pp. 408–409. Illustrated description of plant; all sewers throughout whole scheme are of cast iron with lead-calked joints; treatment provides for mechanical aeration combined with compressed air blown in from underneath, for filtration, and for sterilization by chlorine gas; provision for double system of main sewers throughout whole 7-mile length of town.

Plants, Walden, N.Y. New Sewage Treatment Plant of Walden, N.Y., N. L. Nussbaumer. *Water Works & Sewerage*, vol. 82, no. 10, Oct. 1935, pp. 355–358. Design and construction of new sewage disposal plant treating sanitary sewage flow of about 250,000 gal per day and costing $280,000; details of pumping station and Venturi flume, cast iron mains and crossings, screens and shredder, etc.; chlorination; settling tanks; Venturi flume and recorder; sludge pumps; sludge beds; gas holder of dry-seal type.

Plants, Waste Utilization, Public Health. Public Health Significance of Sewage Sludge When Used as Fertilizer, F. W. Tanner. *Sewage Works J.*, vol. 7, no. 4, July 1935, pp. 611–617. Caution to be practiced in application of sewage sludge to soil on which vegetables that may be eaten raw, are grown; longevity studies on pathogenic bacteria in sludge; sludge should not be added to growing crops. Before Ill. Assn. Sanitary Districts.

Plants, Waste Utilization, Study of Fertilizer. Adaptability of Sewage Sludge as Fertilizer, E. E. DeTurk. *Sewage Works J.*, vol. 7, no. 4, July 1935, pp. 597–610. Results of study made at Soil Fertility Department of Agronomy at University of Illinois; historical review of sludge utilization; kinds of sludge; activated sludge; digested or Imhoff sludge; fertilizer value; comparison of digested sludge with farm manure; utilization of digested sludge; relation of sludge problem to fertilizer industry. Bibliography.

Refuse Disposal, Digestion. Possibilities of Digestion of Garbage in Sewage Treatment Plant, H. E. Babbitt. *Sewage Works J.*, vol. 7, no. 4, July 1935, pp. 658–662. General discussion of problem and suggestions for further research. Before Ill. Assn. Sanitary Districts.

Sewage Filters, Specifications. Sprinkling-Filter Requirements Revised by New Jersey. *Eng. News-Rec.*, vol. 115, no. 22, Nov. 28, 1935, pp. 753–754. New regulations drafted by state health department permit increased volume of sewage to be treated per unit of filter bed; rates of application during dosing period.

Sewers, Cleaning. Sewer Cleaning with Rubber Beach Balls, A. M. Rawn. *Water Works & Sewerage*, vol. 82, no. 10, Oct. 1935, pp. 359–360. Method developed at Los Angeles County's sewage works for cleaning of sewer 6 to 30 in. in diameter by means of inflated rubber balls propelled by sewage flow as compressible floating plug.

Sludge. Sludge Digestion, J. Bolton. *Surveyor*, vol. 87, no. 2262, May 31, 1935, pp. 677–679. Results of original experiments at Bury, England, leading to conclusion that activated sludge alone is not very amenable to sludge digestion, but mixtures of digested sludge and sedimentation tank sludge can easily be digested by heating to temperature of 80 F; advantages of sludge digestion; separation of water from sludge; analysis of digested sludge. Before Inst. Sewage Purification.

United States. New England and New York Sewage Works Associations Hold Joint Meeting. *Water Works & Sewerage*, vol. 82, no. 11, Nov. 1935, pp. 382–386. Proceedings including abstracts of following papers: Disposal of Sewage Solids, F. W. Mohlman; Cost Records in Maintenance and Operation, J. H. Brooks; Some Fundamentals of B.O.D., E. B. Phelps; Unique Features of Walden (N.Y.) Treatment Plant, N. L. Nussbaumer.

STRUCTURAL ENGINEERING

Beams, Deflection. Coefficients for Beam Deflections Under Various Loading Arrangements, R. Fleming. *Eng. News-Rec.*, vol. 115, no. 25, Dec. 19, 1935, pp. 844–845. Charts and tables permitting vertical deflections of beams to be determined with sufficient accuracy for all practical purposes.

Current Problems. Profession of Structural Engineering and Some of Its Problems, O. Faber. *Structural Engr.*, vol. 13 (new series), no. 12, Dec. 1935, pp. 450–457. Discussion of such problems as public control of structures; steel frame structures; reinforced concrete regulations; town planning; relations with architects. Address before Instn. Structural Engrs.

Statically Indeterminate Structures, Models. Fixed-End Moments by Cardboard Models, W. J. Eney. *Eng. News-Rec.*, vol. 115, no. 24, Dec. 12, 1935, pp. 814–816. New apparatus and procedure for determining elastic constants for Cross method of analyzing indeterminate structures; operations of apparatus and calculating procedure for determining fixed-end load and displacement moments; stiffness factors and carry-over factors; comparison of elastic constants to show effect of footing.

TUNNELS

Railroad, Lining. Ingenious Relining Procedure in Traffic-Burdened Tunnel. *Eng. News-Rec.*, vol. 115, no. 23, Dec. 5, 1935, pp. 774–779. Distorted and deteriorating timber lining of Moffat Tunnel replaced with concrete between frequent train movements and in cold and gas-fouled air; construction procedure; analysis of tunnel-lining concrete; concrete mixing and placing done by special equipment.

Sewer, Earth Pressure. Observed Earth Pressures on Deep Sewers in Tunnel, C. R. Young and W. B. Dunbar. *Can. Engr.*, vol. 68, no. 20, May 14, 1935, pp. 9–14. First recorded attempt to determine loads arising from undisturbed ground; abstract of report of cooperative study by Department of Works, Toronto, and University of Toronto, on deep trunk sewers of North Toronto.

Vehicular, Paris. Paris, les autoroutes souterraines de grand trafic à grande profondeur, G. Bardet. *Travaux*, vol. 19, no. 28, Apr. 1935, pp. 157–162. Review of street traffic conditions in Paris and outline of proposed plan for facilitating it by means of deep vehicular tunnels for by-passing through traffic.

Vehicular, Ventilation. Mersey Tunnel Ventilating System. *Engineer*, vol. 160, no. 4166, Nov. 15, 1935, p. 512. Particulars of equipment; motors, transformers, switch and control gear for ventilating equipment, manufactured by Metropolitan-Vickers Electrical Co.; number of pilot wires has been reduced to minimum by company's system of graduated impulses, which allows number of different signals to be sent over same line.

WATER PIPE LINES

Leakage. Die Dichtigkeitspruefung grosser Rohrleitungen und Kanaele, E. Marquardt *Gesundheits-Ingenieur*, vol. 58, nos. 5, 6, and 7, Feb. 2, 1935, pp. 62–67; Feb. 9, pp. 78–82; and Feb. 16, pp. 86–92. Study of European and American data on water losses from pipe lines and infiltration into sewers; testing methods and apparatus for flow line and pressure pipe and sewer lines.

Water Hammer. Water Hammer in Water Supply Engineering, S. L. Kerr. *Water Works Eng.*, vol. 88, no. 3, Feb. 6, 1935, pp. 119–120. Theories of water hammer; velocity of surge wave; risk from automatic regulating valves; problem of discharge conduits of centrifugal pumps; new aspects of water hammer problem.

Water Distribution Systems, Design. Planned Future for Distribution System, C. R. Bird. *Am. Water Works Assn.—J.*, vol. 27, no. 7, July 1935, pp. 905–911. Discussion of basis for future design.

WATER RESOURCES

New York City. City of New York Is Denied Additional Long Island Water. *Water Works Eng.*, vol. 88, no. 2, Jan. 23, 1935, pp. 84–86 and 89–90. Reasons for adverse decision by Water Power and Control Commission of State of New York; ground waters of western Long Island are now so overdrawn as to presage destruction of potable supply of over 100 mgd; present allocation and use of ground waters in boroughs of Brooklyn and Queens.

Regional Planning, Watersheds. Art of Planning As Related to Watershed Control, M. W. Cowles. *Am. Water Works Assn.—J.*, vol. 27, no. 7, July 1935, pp. 866–875. Pollution of streams; changes in population growth; planning municipalities; control of real-estate development; control of watersheds.

Underground, Pollution. Industrial Pollution of Ground Waters, W. M. Brown. *Water Works Eng.*, vol. 88, no. 4, Feb. 20, 1935, pp. 171–177. Pollution of underground waters by absorption of industrial wastes; material transported by mountain streams; oil industry as worst offender; water salinity at oil operators' sumps; unlined ditches and sumps a menace; sea water intrusion. Before Am. Water Works Assn.

Underground, Texas. Geology and Ground-Water Resources of Atascosa and Frio Counties, Texas, J. T. Lonsdale. *U. S. Geol. Survey—Water Supply Paper*, no. 676, 1935, 90 pp., 10 supp. plates. Price, 35 cents. Results of cooperative project between Engineering Experiment Station, Texas Board of Water Engineers, and U. S. Geological Survey, for determinating ground-water resources in area, with special reference to supply available for irrigation; geologic formations and their water-bearing properties; well drilling and pumping methods; quality of water; records of wells.

United States. Shortage of Public Water Supplies in United States During 1934, G. F. White. *Am. Water Works Assn.—J.*, vol. 27, no. 7, July 1935, pp. 841–854. List of public water supplies experiencing shortage during 1934 classified by population and source; supplies having chronic shortage. Bibliography.

Watersheds, Protection. Guarding Watersheds Against Pollution. *Water Works Eng.*, vol. 88, no. 4, Feb. 20, 1935, pp. 187–188, and 191–192. Practical discussion by water works superintendents of provisions for protecting watersheds against pollution from such sources as domestic sewage, agricultural occupancy, recreational activities, railway right-of-ways, and vehicular highways.

WATER TREATMENT

Aeration. Aeration of Water by Air Diffusion, F. C. Roe. *Am. Water Works Assn.—J.*, vol. 27, no. 7, July 1935, pp. 897–904. Review of practice and experience of six water treatment plants in United States practicing water aeration by means of diffusion through porous plates and tubes; aeration objectives; design; cost. Bibliography.

Carbon. Dilution and Carbon Treatment Make Salty Well Water Palatable, E. W. Steel. *Water Works Eng.*, vol. 88, no. 3, Feb. 6, 1935, pp. 138 and 141. Experience of water works of Bryan, Tex.; admixture of well waters containing respectively 344 ppm and 1,050 ppm of common salt used without consumer complaint.

Chlorination. Chlorine and Chloramines in Water Treatment, A. E. Griffin. *Can. Engr.*, vol. 68, no. 20, May 14, 1935, pp. 17–18. Ammonia used in conjunction with chlorine to prevent taste development; advantages of prechlorination and what it accomplishes; elimination of taste and odor.

Purification. Some Studies on Water Purification, A. H. Waddington. *Water & Water Eng.*, vol. 37, nos. 443 and 444, Jan. 1935, pp 28–31, and Feb. pp. 57–61, (discussion) pp. 61–64. January: Sedimentation; filtration; neutralization; sterilization; taste and odor control; new supplies and choice of plant. February: Practical and experimental work; municipal softening; plant control; testing equipment; chemical control. Before Instn. Sanitary Engrs.

WATER WORKS ENGINEERING

Future Supplies. Planning for Future Water Supply, D. Lloyd and D. Walton. *Engineer*, vol. 160, no. 4166, Nov. 15, 1935, pp. 503–505. Recommendations for programs of regional advisory water committees; data needed; statistical analysis; uniform growth of demand; graph of total supply; effect of temperature; casual fluctuations.

Great Britain. National Water Policy. *Water & Water Eng.*, vol. 37, no. 445, Mar. 1935, pp. 89–91. Report of joint conference of Institution of Water Engineers, British Water Works Assn., and Water Companies Assn. on National Water Policy; preliminary considerations; proposals.

Honolulu. Safeguarding Honolulu Against Water Famine, F. Ohrt. *Water Works Eng.*, vol. 88, no. 2, Jan. 23, 1935, pp. 66–69. Measures adopted for conservation of artesian water supply of town; description of pumping plants; connection between pumps and reservoirs; cylindrical concrete reservoirs; increase in efficiency reflected in insurance rates.

Intakes. Montreal to Build New Intakes for St. Lawrence River Water. *Eng. News-Rec.*, vol. 115, no. 25, Dec. 19, 1935, pp. 849–850. Construction of water-works river intake structures consisting of 6 lines of concrete pipe with 7-ft diameter to extend 2,200 ft out into river; estimated cost, $1,200,000.

For bridges exposed to Scour

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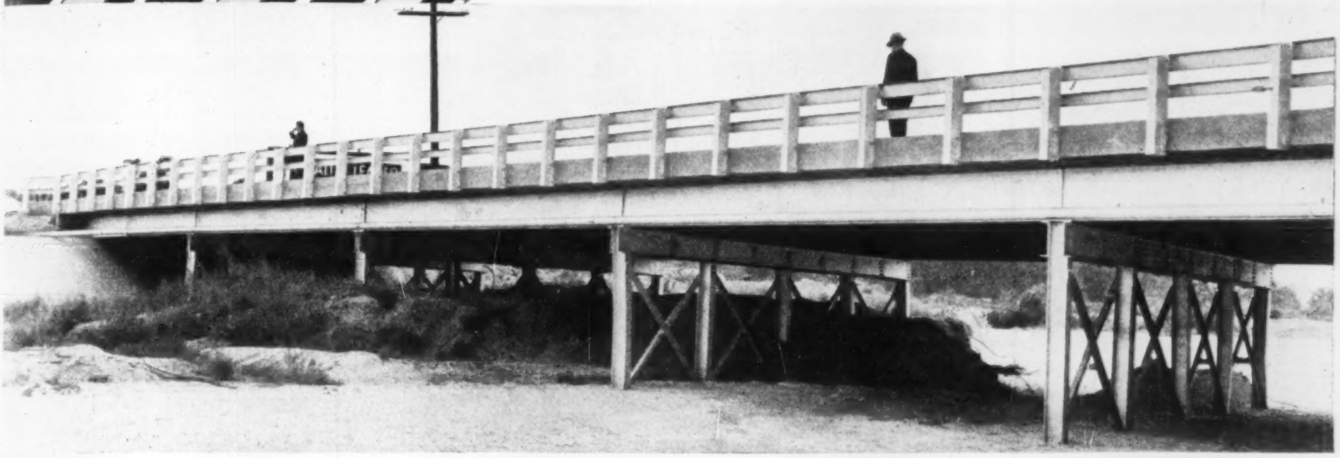
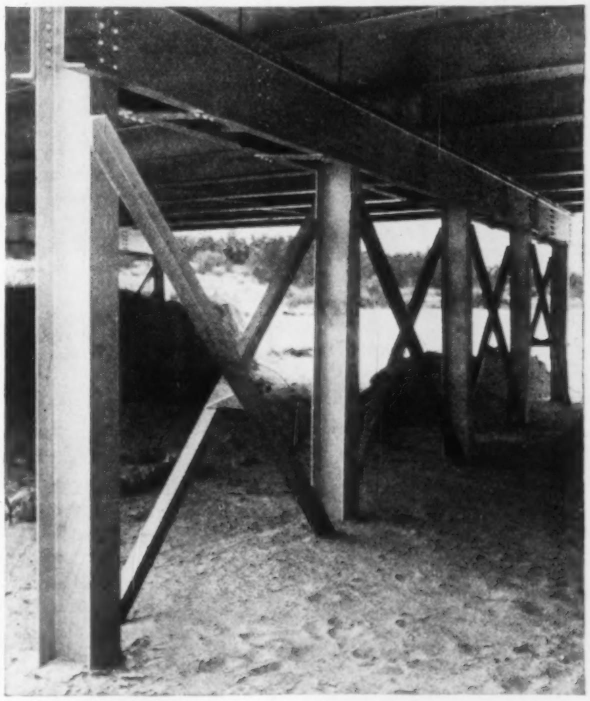


This bridge, at San Bernardino, Cal., is built on Bethlehem Steel H-Piles. Note the alignment and sturdy appearance of the steel H-piling bent, as shown in the lower illustration. The steel girders of the bridge rest on a cap consisting of two structural-steel channels, riveted to the H-piling.



A BRIDGE like the one shown in the two photographs, crossing a shallow stream bed, represents a difficult problem—or did, before the possibilities of steel H-piling were understood.

Dry during most of the year, at certain seasons a stream bed may become a raging torrent, causing deep scour that often undermines bridge foundations. To prevent such damage the bridge foundations must be driven deep—securely below the zone of possible scour. Steel H-piles are so useful in meeting this problem because they have strength and toughness to stand up under the continuous hard driving that is needed to force them through beds of sand and gravel to the required penetration.

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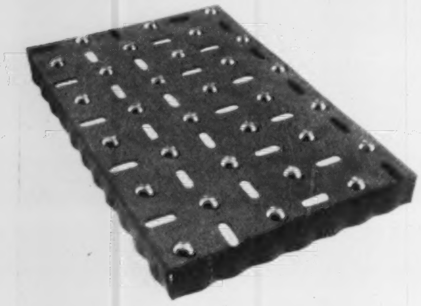


Bethlehem Steel Paving Plates are of $^{1}/_{8}$-in. rolled steel, and are available in two types. One is intended for use on roadways; the other for plant floors, loading platforms, and docks. Both types are identical, except that the one for roadways is equipped with button-head studs. As shown in the accompanying illustration, the sides of the plates are perpendicular to the surface, and are crimped to give the plates firm anchorage in the concrete. Additional anchorage is provided by studs which extend into the concrete.

The floor-type Bethlehem Steel Paving Plate has a smooth surface, and like the road plates, the floor plates are anchored securely to the concrete slab and become, in effect, an integral part of it. The standard size of these Bethlehem Paving Plates is 12 in. by 18 in., with $1^{1}/_{2}$-in. sides. A four-page illustrated folder No. 354, describes both new types of paving plates, designed for use on roadways, plant floors, loading platforms, and docks. Suitable sketches provide instruction details for installation. Copies of this folder may be had on request.

Worthington Booklets

The Worthington Pump and Machinery Corporation of Harrison, N.J., has published new booklets on their horizontal duplex piston pumps, double helical rotary pumps, and diesel engines.

Copies will be forwarded by the manufacturer.

Douglas Fir Use Book

A new and enlarged handbook for engineers, giving load tables for Douglas fir lumber, formulas for various kinds of loading, and other structural and design data, has been issued recently by the West Coast Lumbermen's Association, 364 Stuart Building, Seattle, Washington.

The Douglas Fir Use Book has been designed to supply all the data about Douglas fir that a designer would need in using this lumber for any construction purpose. It includes information on basic laws for stress grades and notes on their use; properties and factors related to longitudinal shear, compression and tension stresses, deflection, effect of duration of time of load, and factors of safety; an exposition of timber connectors—split rings, toothed rings, and shear plates; grade marking; a grade-use guide that describes grades and makes grade-use recommendations; formulas for various kinds of loading—bending, shear, deflection and deflection loads; properties related to weight, areas, section moduli, moment of inertia, and moments of resistance; inch-width loads; span tables for joists and beams; maximum spans for joists and beams; loads for plank and laminated floors and roofs; loads for posts and struts, and loads for studding.

This handbook of 209 pages of technical information, $8^{1}/_{2}$ in. by 11 in. in size, is being sold at $1.00 per copy.

Forms for Architectural Concrete

The dearth of information in both American and foreign literature on forms for concrete construction and the rapid growth of the use of concrete as an architectural material have prompted the publication by the Portland Cement Association of a 64-page booklet devoted exclusively to forms for architectural concrete work. It is believed that the technic and craftsmanship of such form construction are quite different from that for structural concrete although fundamentally the same principles apply. Every conceivable detail has not been included in the booklet but sufficient examples are given and suggestions are made regarding those things requiring special attention to enable a careful contractor to produce a thoroughly satisfactory job. The booklet also contains much information useful to engineers and architects in the preparation of specifications for architectural concrete work.

Copies may be had without charge from the Portland Cement Association, 33 West Grand Ave., Chicago, Ill.

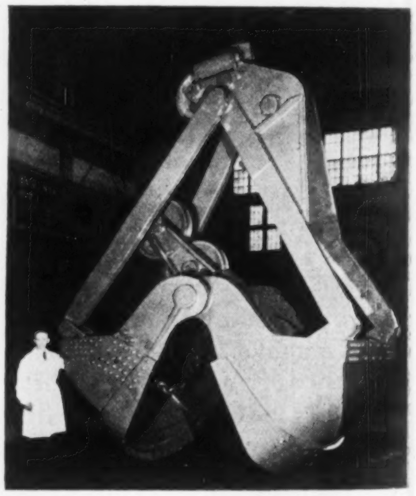
Standard Specifications for Brick Pavements

The National Paving Brick Association announces the publication of standard specifications for vitrified brick pavements, with brick parking strips and gutters. These specifications cover materials details and construction methods, including such new items as the surface removal method of filler application, the vertical fiber lug brick and the bituminous mastic type of cushion.

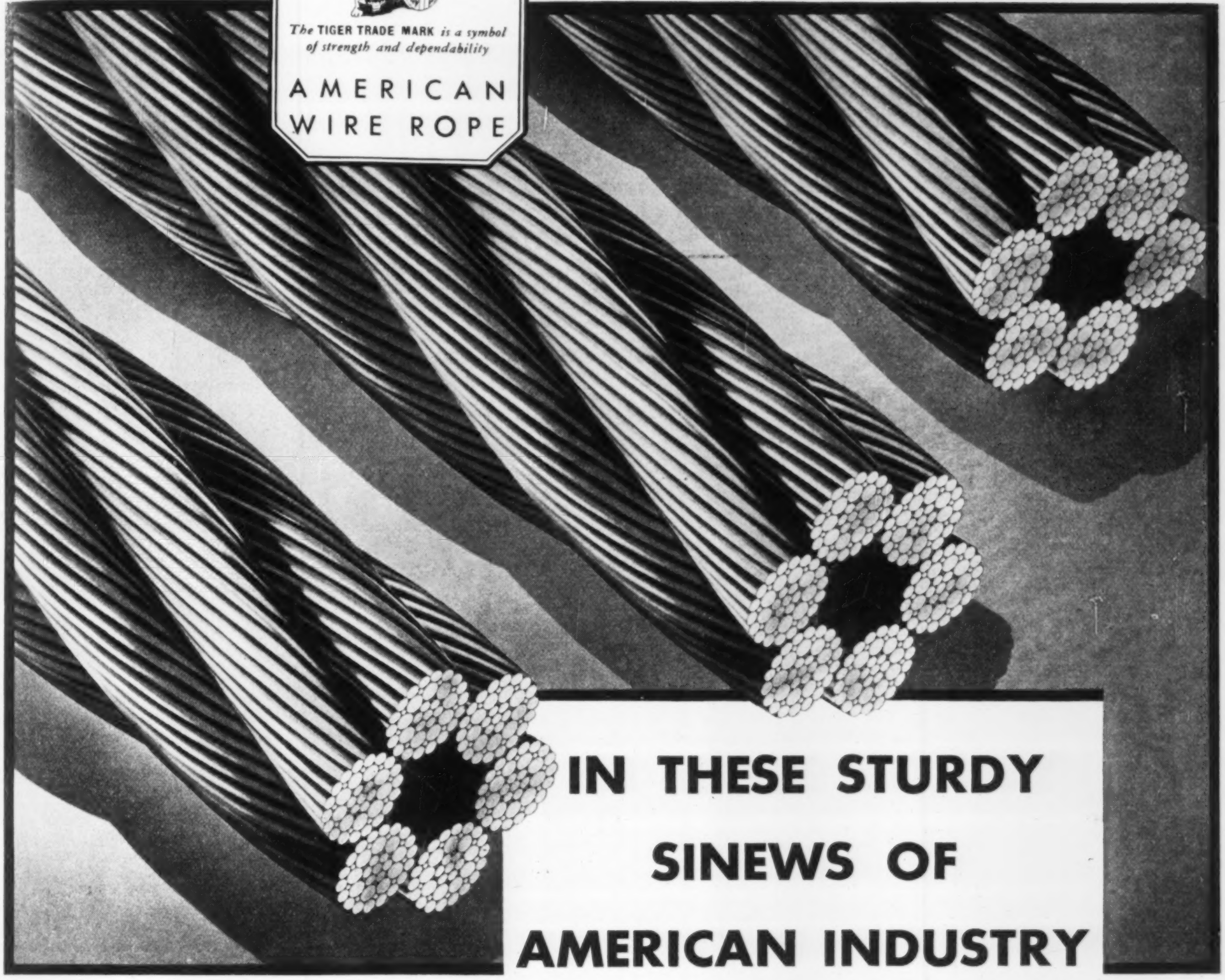
Copies of these standard specifications may be obtained from the National Paving Brick Association, National Press Building, Washington, D.C.

All-Welded, 6-Cu Yd Dredging Bucket

The Wellman Engineering Company, Cleveland, Ohio, announces the construction of a special 6-cu yd capacity, power-arm type of Williams Clam Shell Dredging Bucket, designed for severe service in under-water excavating. The illustration shows the completed bucket on the erecting floor. Some idea of its size can be realized from the fact that its total height is over 17 ft 0 in., and its weight when empty is 30,000 lbs.



This bucket was engineered by Wellman, to withstand the unusual strains and stresses to which a bucket of this size might be subjected in dredging operations. A design using all-welded parts in place of the customary castings was adopted to utilize those high-strength, low-carbon, alloy steels, which have the physical values required for perfect welding fabrication. This construction, in the opinion of the manufacturer, permitted of a lessening and a better distribution of the weight, with added strength where most needed.



The **TIGER TRADE MARK** *is a symbol of strength and dependability*

AMERICAN WIRE ROPE

IN THESE STURDY SINEWS OF AMERICAN INDUSTRY

you'll find the rope best suited to your needs!

AND you won't find a kink in any of these sinews . . . no "charley-horse" to cripple your production.

More than 100 years of experience has taught us many valuable things regarding wire rope . . . both regarding the problems facing the industrial user . . . and in manufacturing the proper rope to lick these troublesome problems.

In fact, hundreds of companies have standardized on American Steel & Wire Company Wire Rope . . . because they have confidence in it. This confidence was gained by unusual service records, dependability and lowered operating costs.

Therefore, we would suggest that you get in touch with our engineering department for cooperation in solving your particular problems, or . . . see our nearest distributor.

AMERICAN STEEL & WIRE COMPANY
208 S. La Salle Street, Chicago Empire State Building, New York
Pacific Coast Distributors: Columbia Steel Co., San Francisco.
Export Distributors: United States Steel Products Co., New York.

US STEEL

UNITED STATES STEEL

Civil Engineer; Jun. Am. Soc. C.E.; 31; married; 2 years Purdue University; 1½ years Massachusetts Institute of Technology. Experience covers responsible charge of all types of surveys (on highways and bridges). Triangulation, construction and design of highways, construction of parkways and bridges, drafting, mechanical and topographical. Available on short notice. D-4475.

Graduate Engineer; Jun. Am. Soc. C.E.; Michigan State College, 1935; age 28; weight 200 lb; height 6 ft. Experience: U. S. D. I. park service; surveying, U. S. Department of Agriculture Biological Survey as a junior civil engineer. Surveys; design of ditches, dikes, and roads. Locality immaterial, but prefer cooler climates. Thesis: First Order Survey and Triangulation. D-4596.

Recent Graduate; Jun. Am. Soc. C.E.; single; 23; C.E., Rensselaer Polytechnic Institute, 1935; Sigma Xi; good draftsman and structural steel designer; would like position with opportunity for advancement in organization working with structural steel, especially bridges; location depends upon opportunity but would prefer the East; 2 months experience as transitman. D-4436.

Civil Engineer; Jun. Am. Soc. C.E.; 24; single; B.S. in C.E., 1933. Majored in structural engineering; 1 year experience on road construction surveying; 6 months experience in drafting and design of large transport; 4 months experience in bridge inspection. Desires position. Location immaterial. Available immediately. D-3554.

Civil Engineer; Jun. Am. Soc. C.E.; 23; married; B.S. and M.S. in C.E., University of Colorado; graduate work in hydraulics and structures; 6 months experience as instructor; 6 months as instrumentman, U.S. Coast and Geodetic Survey; 1 year with the U.S. Bureau of Public Roads. Desires opportunity in any branch of civil engineering; prefers design or construction. Location immaterial. Available immediately. D-4282.

Civil Engineer; Jun. Am. Soc. C.E.; 28; single; B.S.C.E., Drexel Institute, 1931; 5 years experience in model hydraulic turbine laboratory test and cavitation research work, field test-current meter, piezometer; 1 year on timekeeping, inspection, surveying on construction. Excellent references. Desires permanent position with opportunity in any branch of civil engineering. Location immaterial. Available short notice. D-4655.

Civil Engineer; Jun. Am. Soc. C.E.; 29; single; B.Sc.C.E., 1927; 5 years on major county and state highways (asphalt and concrete) as draftsman, estimator, office computer, design, instrumentman, inspector; 2 months structural steel detailing; 7 months estimating service station construction costs and dredging; 6 months heating and air conditioning; 14 months as draftsman on aerial photo-compilation. D-4593.

Civil Engineer; Jun. Am. Soc. C.E.; 25; single; B.S. in C.E., California Institute of Technology, 1933; 3 months structural drafting; 3 months tunnel work on Colorado River aqueduct; 3 months surveying, U.S. Geological Survey; 1½ years on operation of equipment in chemical plant. Reserve officer. Opportunity in civil engineering desired, preferably in surveying. D-4674.

Civil Engineer; Jun. Am. Soc. C.E.; 26; single; B.S.C.E., University of Michigan; 6 months experience instrumentman, Jersey Homesteads Project, Resettlement Administration. Desires position in any branch of civil engineering with private concern. Location immaterial; available immediately. D-4072.

Civil Engineer; Jun. Am. Soc. C.E.; 24; single; B.S. in C.E., Rhode Island State College. Majored in bridge design, roads and water supply; 2 years experience as industrial engineer; 2 years experience as instructor in "Practical Surveying." Location immaterial. Desires opportunity. Excellent recommendations. D-4567.

Civil Engineer; Jun. Am. Soc. C.E.; single; B.S.C.E. University of Illinois, 1935; 6 months experience as surveyor, New York state flood control survey; 2 summers on railroad maintenance. Available immediately. Will locate anywhere. Excellent draftsman. Real capacity for hard work. D-4653.

Miscellaneous

Draftsman; Jun. Am. Soc. C.E.; age 28; single; 3½ years experience in design and construction of sewers and their appurtenances; 2 years experience in making maps and quantity estimates for river dredging (maps made from aerial photographs). Location and salary secondary. Can give excellent references. Available immediately. D-3919.

Teaching

Structural Engineer; Assoc. M. Am. Soc. C.E.; 35; B.S., M.S., PhD.; experienced in design, research, and teaching; will be available for teaching mechanics and structural engineering September 15. C-3736.

Civil Engineer; Jun. Am. Soc. C.E.; B.S.C.E.; M.S.C.E.; additional graduate work in structures, highways, hydraulics, mechanics; 5 years teaching structures and surveying at midwestern state university; 1 year teaching surveying, drawing, and mathematics at another university; 1¼ years as structural detailer; 1 year on highway and lock construction, surveying; several publications. C-6966.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1935. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

Civil Engineer's Handbook. By International Correspondence Schools, Scranton, Pa. International Textbook Co., 1935. 368 pp., diagrs., charts, tables, 6 × 4 in., cloth, $1.

This handbook contains a collection of data frequently used by surveyors and by railroad, highway, sanitary, and hydraulic engineers. The book is small enough to be carried in the pocket conveniently, and is clearly printed and well bound.

Crosby-Fiske-Forster Handbook of Fire Protection. 8 ed. Edited by R. S. Moulton; published and distributed by National Fire Protection Association, Boston, and D. Van Nostrand Co., New York. 1154 pp., illus., diagrs., charts, tables, 7 × 5 in., leather, $4.50.

Ownership of this well-known handbook on fire prevention and protection has been transferred to the National Fire Protection Association, which has prepared this new edition, the first since 1924. The work has been completely revised and brought up to date by the inclusion of new developments, so that it provides a comprehensive, authoritative review of accepted practice.

Einführung in die Angewandte Akustik. By H. J. von Braunmühl and W. Weber. Leipzig, S. Hirzel, 1936. 216 pp., illus., diagrs., charts, tables, 9 × 6 in., paper, 9.20 rm.; bound, 10.70 rm.

After a brief presentation of the physical and physiological basic principles, this introduction to applied acoustics discusses the instruments and processes used in receiving, transmitting, reproducing, and recording and measuring sound, and the acoustics of buildings. The work is comprehensive and designed to give a survey of the subject of use to sound engineers, architects, and students.

Graphic Course of Patentable Inventions. By H. A. Toulmin, Jr. New York, D. Van Nostrand Co., 1935. 40 pp., tables, 9 × 6 in., paper, $1.

The procedure to be followed in caring for a patentable invention, from its conception to its final protection in the courts, is explained in this pamphlet. By use of graphic "flow" charts, accompanied by concise paragraphs of explanation, the intricate steps are made clear. The book should be useful to inventors.

Graphical Solutions. By C. O. Mackey. New York, John Wiley & Sons, 1936. 130 pp., diagrs., charts, tables, 9 × 6 in., cloth, $2.50.

This textbook offers an elementary course in methods for the graphical and mechanical solution of equations, intended for use in engineering schools. Stationary adjacent scales, sliding scales, network charts, and alignment charts are discussed, and a final chapter is devoted to the determination of the values of the constants in non-periodic equations. The mathematics used is simple.

Great Britain, Department of Scientific and Industrial Research. Report of the Building Research Board for the Year 1934. London, His Majesty's Stationery Office, 1935. 174 pp., illus., diagrs., charts, tables, 10 × 6 in., paper, 3s. 6d. (Obtainable from the British Library of Information, $1.10.)

This report contains an account of the researches carried out during the year upon weathering, building materials, structures, and the efficiency of buildings from the user's viewpoint, together with a list of the publications of the year by the Bureau and staff members.

Index to A.S.T.M. Standards and Tentative Standards, January 1, 1936. Philadelphia, American Society for Testing Materials. 160 pp., 9 × 6 in., paper, apply.

The standards and tentative standards of the society which were in effect on January 1, 1936, are included in this index, with reference to the publication where they appear. A numerical list is also included, making the index a convenient guide for locating any specification or method of test that has appeared. The publication is furnished free, on written request.

Schweiz. Verband für die Materialprüfungen der Technik (S.V.M.T.) Association Suisse pour l'Essai des Materiaux (A.S.E.M.) Bericht Nr. 33. Theorie und Versuchsforschung im Stahlbau, by F. Bleich. Zürich, Switzerland, January 1935. 28 pp., diagrs., charts, 12 × 8 in., paper, apply.

In this address, delivered before a convention of Swiss engineers, Dr. Bleich discusses various problems of steel construction with reference to their importance in regard to its economics, and the prospects of their elucidation by theory and experiment. The dimensioning of statically indeterminate systems, the dimensioning of reinforced concrete foundations for heavy steel structures, the frame corner, the diffusion of stress, and stability are discussed.

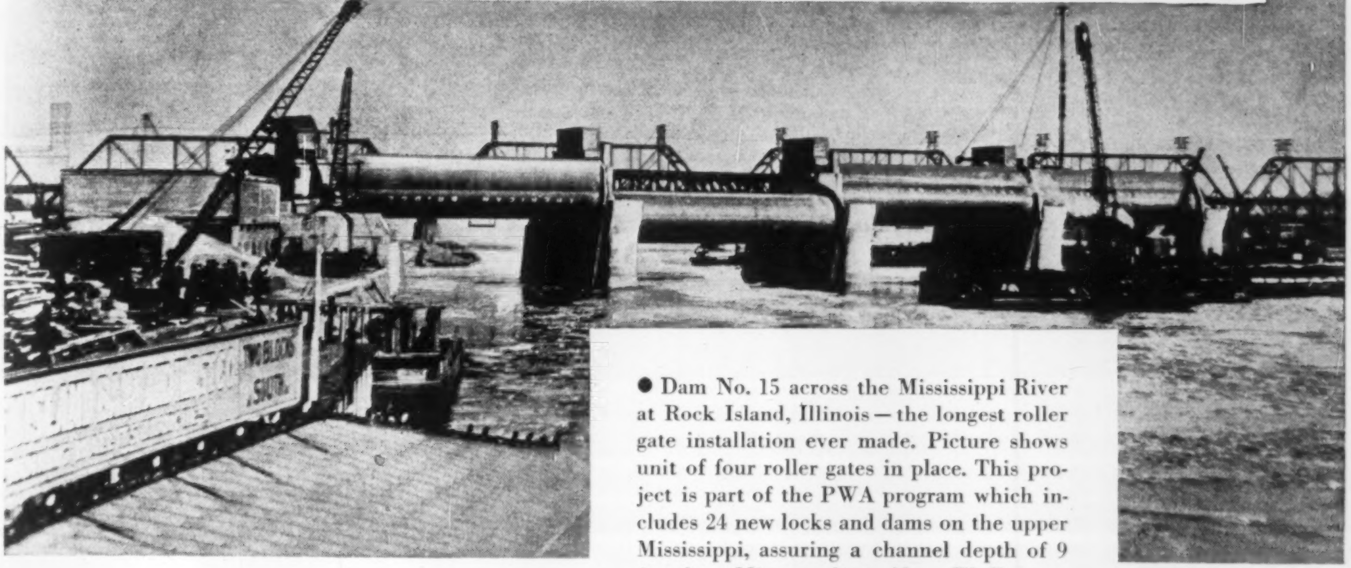
Steadyflow Traffic System. By F. Malcher. Cambridge, Harvard University Press, 1935. 91 pp., diagrs., charts, tables, 10 × 7 in., cloth, $1.

This book presents, for the first time, a comprehensive description of the author's system of traffic regulation through street design, known hitherto only through magazine articles and pamphlets. The fundamentals of street design and the economic aspects of the system and its application to existing traffic problems are discussed. The system eliminates completely all right-angled traffic intersections.

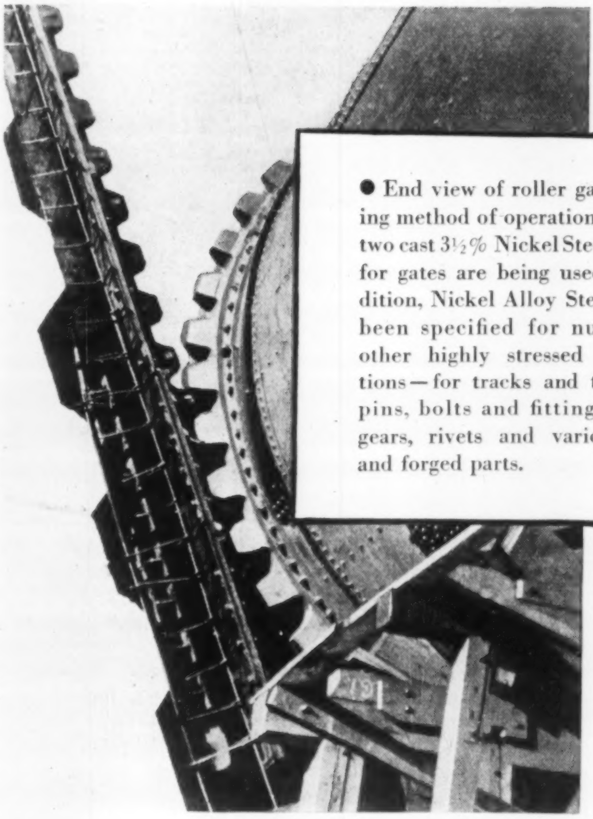
Technik Geschichte. Im Auftrage des Vereines deutscher Ingenieure. Edited by Conrad Matschoss. (Beiträge zur Geschichte der Technik und Industrie, Bd. 24, 1935.) Berlin, VDI-Verlag, 148 pp., illus., diagrs., charts, tables, 12 × 9 in., cloth, 12 rm.

In commemoration of the centenary of German steam railroads, the current volume of this annual is devoted to railroad developments, especially German ones. Papers are included on the first German locomotive builders, on railway contributions to structural engineering and to materials, on the history of car wheels and signal apparatus, etc.

Roller Gates Equipped with NICKEL STEEL... stop Old Man River from Rollin' Along



● Dam No. 15 across the Mississippi River at Rock Island, Illinois — the longest roller gate installation ever made. Picture shows unit of four roller gates in place. This project is part of the PWA program which includes 24 new locks and dams on the upper Mississippi, assuring a channel depth of 9 feet from Minneapolis to Alton, Ill. Because of their superior toughness, strength, and resistance to stress and fatigue over 200 tons of Nickel Steels were used on this job.



● End view of roller gate showing method of operation. Thirty-two cast 3½% Nickel Steel rollers for gates are being used. In addition, Nickel Alloy Steels have been specified for numerous other highly stressed applications — for tracks and trunnion pins, bolts and fittings, hoist gears, rivets and various cast and forged parts.

MISSISSIPPI RIVER
DAM No. 15

● Nickel Steel bulkhead truss assembled before installation. The high strength and toughness of Nickel Steel help to increase the life of structures and equipment long beyond the period of bond issues that finance them — an important point for the civil engineer to consider in specifying materials for new projects.

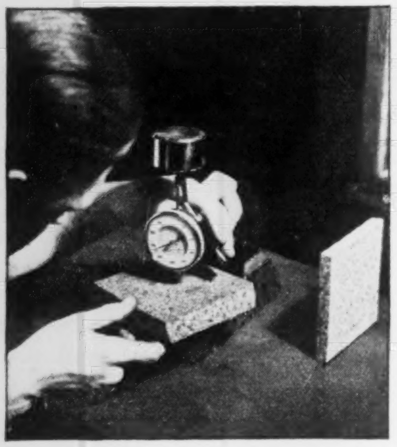
NICKEL ALLOY STEELS

FREE *Every engineer who specifies materials will find this handy Nickel Alloy Steel Chart invaluable. Gives important properties of various Nickel Alloy Steel constructional compositions — tensile strength, yield point, hardness, etc. For your copy, address Dept. CE-3.*

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

New Self-Expanding Joint for Concrete Pavements

A NEW self-expanding cork expansion joint for concrete pavements, applicable to old as well as new construction, has just been announced by Johns-Manville, New York. Known as S-E (Self-Expanding) Cork Expansion Joint, this new product is a development by the Johns-Manville Research Laboratories of the standard J-M Cork Expansion Joint which has been widely used in concrete construction—both in roads and in buildings—for several years. In making S-E Joint the material is first fabricated into the standard joint material. Then the moisture is removed and the cork compressed to approximately 60 per cent of its original thickness. To hold this S-E Joint in its compressed state it is necessary only to prevent re-absorption of moisture, so immediately after compression it is wrapped in a water-resistant package which is not removed until just before installation.



In its application to old construction, the S-E Joint is unwrapped at the job, immersed in water to hasten the expansion which would normally come through exposure to the moisture in the air, then slipped into place. The moisture causes the cork to expand, filling the slot snugly, and providing a tight seal against water, dirt, and other foreign material.

Another important use for the new S-E Cork Expansion Joints, Johns-Manville points out, is its application to new highways. Here the S-E Joint is slipped into place without immersion in water. The moisture in the wet concrete is slowly absorbed by the cork and, as the concrete hardens, the S-E Joint expands to provide an absolutely tight joint without setting up any strain in the concrete itself. If the highway is laid in hot, humid weather, when concrete is at its maximum of expansion, the use of S-E Joint is of particular value, according to the announcement, because of S-E Joint's ability to expand to a thickness 140 per cent of that at which it is installed.

The S-E Cork Expansion Joint does not replace the standard J-M Cork Expansion Joint as both will be manufactured, it is stated in the announcement.

New Electrode for Welding Bronze, Brass, and Copper

AN ENTIRELY new field of welding is opened up by a phosphor bronze arc-welding electrode according to the announcement of the Lincoln Electric Company, Cleveland, Ohio.

"Aerisweld," as the new electrode is called, has been thoroughly tested in the practical welding of bronze, brass, and copper in many applications. It is said to provide a solid homogeneous deposit, having characteristics of true phosphor bronze with notably high tensile strength.

"Aerisweld" is a shielded-arc electrode, for use with the metallic arc. Its coating, as it burns, produces a gas which shields the molten metal from harmful effects of the atmosphere and assists in easing the flow of molten metal in the arc.

In using "Aerisweld," welding current of positive polarity is employed on the electrode. Preheating of the parts is unnecessary when welding any ferrous metal and the lighter grades of copper and bronze. Where heavy bronze or copper is to be welded some preheating may be desirable owing to the high heat conductivity of these metals. In some cases, preheating is easily accomplished by using a carbon electrode with negative polarity and rapidly moving the arc over the area to be welded. For cast iron, low current is used since excessive heat is detrimental to satisfactory welding of this metal.

"Aerisweld" electrode is made in two sizes, 5/32 in. and 3/16 in., 14-in. lengths and comes packed in standard containers of 5 lb net each size.

A New Booklet on the Heroult Electric Furnace

The American Bridge Company announces the publication of a 20-page booklet describing the Heroult Electric Furnace as used in modern steel making. The adaptibility of the electric furnace and the practical advantages of the Heroult design are discussed. In addition, the booklet outlines and illustrates the types, sizes, capacities, and installation requirements for Heroult furnaces.

Copies are available on request addressed to the American Bridge Co., Frick Building, Pittsburg, Pa.

New Chain Belt Catalogs

THE CHAIN Belt Company announces the publication of the first four of a series of new 1936 catalogs. These four include a 16-page catalog on the Rex $3^1/_2$ S and 5 S mixers, a 16-page catalog on the Rex 7 S and 10 S mixers, an 8-page catalog on the Rex 14 S mixer, and a 20-page catalog on the Rex 27 E paver. All catalogs illustrate and describe the improvements in this equipment.

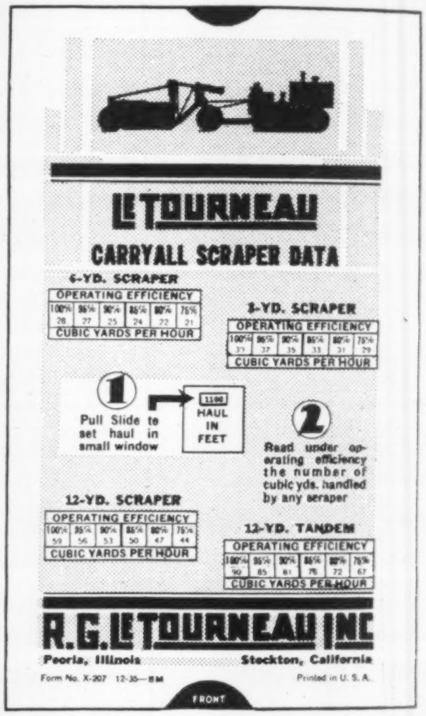
Copies may be obtained from the Chain Belt Company, 1600 W. Bruce Street, Milwaukee, Wis.

Haynes Stellited Valve Booklet

THE HAYNES Stellite Company announces the publication of a new eight-page booklet, "Haynes Stellited Valves." Increased life and economy resulting from the application of Haynes Stellite to the seating surfaces of valves for use in high-temperature, high-pressure, steam service are fully described. Freedom from wire-drawing, galling or seizing, and corrosion is insured by hard-facing steam valves with this cobalt-chromium-tungsten alloy. Copies of this descriptive illustrated booklet may be obtained from the Haynes Stellite Company, Kokomo, Ind.

A New Calculator for Determining Earth Moving Cost and Yardage Figures

A READY reference calculator for quickly determining probable yardage output and cost when moving dirt with Le Tourneau Carryall Scrapers is now available to civil engineers.



LETOURNEAU

CARRYALL SCRAPER DATA

6-YD. SCRAPER

OPERATING EFFICIENCY					
100%	95%	90%	85%	80%	75%
28	27	25	24	22	21
CUBIC YARDS PER HOUR					

8-YD. SCRAPER

OPERATING EFFICIENCY					
100%	95%	90%	85%	80%	75%
39	37	35	33	31	29
CUBIC YARDS PER HOUR					

① Pull Slide to set haul in small window

1100 HAUL IN FEET

② Read under operating efficiency the number of cubic yds. handled by any scraper

12-YD. SCRAPER

OPERATING EFFICIENCY					
100%	95%	90%	85%	80%	75%
59	56	53	50	47	44
CUBIC YARDS PER HOUR					

12-YD. TANDEM

OPERATING EFFICIENCY					
100%	95%	90%	85%	80%	75%
90	85	81	76	72	67
CUBIC YARDS PER HOUR					

R. G. LETOURNEAU INC

Peoria, Illinois Stockton, California

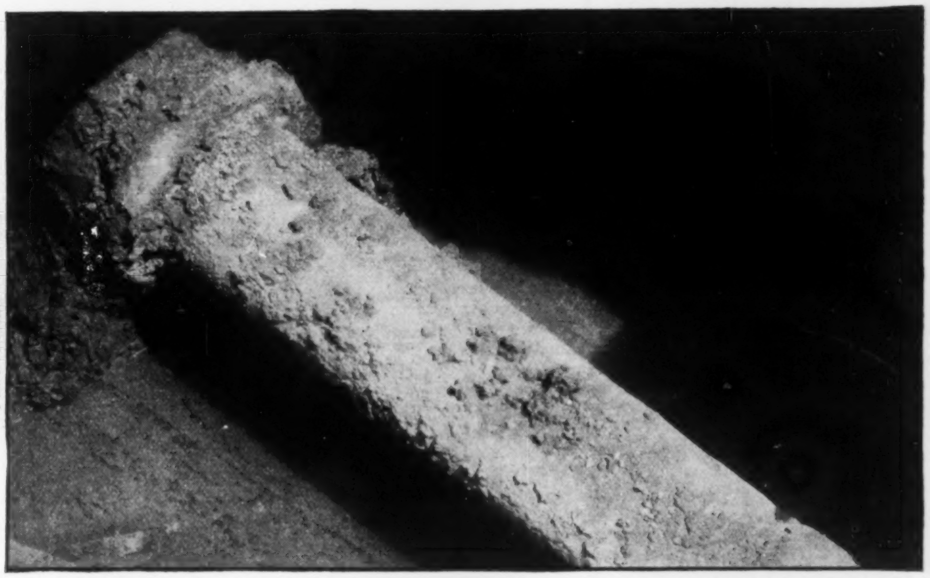
Form No. X-207 12-35—8M Printed in U. S. A.

FRONT

This pocket-size calculator gives production figures for hauls ranging from 200 to 3,000 ft with the tandem hookups of 12-yd, 8-yd and 6-yd Carryall Scrapers, and the cost per cu yd, based on operating expenses progressing from $2.00 to $7.50 an hour. A low expense range is given for figuring yardage costs on actual cash outlay without provision for depreciation, repairs, and overhead. A higher range includes all costs.

The calculators may be obtained from Le Tourneau dealers or from R. G. Le Tourneau, Inc., Peoria, Ill., or Stockton, Calif. Request form No. X-207.

PHILADELPHIA'S *mains for water distribution are* 98.3% CAST IRON PIPE



Section of 106-year-old cast iron water main still rendering satisfactory service in Philadelphia's distribution system.

The following tabulation **shows the percentage of cast iron pipe used in the water distribution systems of the 15 largest cities in the United States as reported by their Water Departments.**

CITY	PERCENTAGE
New York	97.2
Chicago	100.0
Philadelphia	98.3
Detroit	98.7
Los Angeles	74.0
Cleveland	98.9
St. Louis	98.7
Baltimore	99.7
Boston	99.8
Pittsburgh	97.9
San Francisco	76.8
Milwaukee	100.0
Buffalo	99.8
Washington D.C.	98.8
Minneapolis	95.8

INCLUDED in the 2471 miles of pipe in Philadelphia's water distribution system—*98.3% cast iron*—is the oldest cast iron water main in America, functioning satisfactorily after 114 years of service. With a peak consumption of 378 million gallons daily, Philadelphia's system has a pumping capacity of 705 million gallons daily of raw water from the Schuylkill and Delaware Rivers. There are more than 110 acres of slow sand filter beds.

The average percentage of cast iron pipe in the water distribution systems of the 15 largest cities in the United States is 95.6%. Cast iron pipe is the standard material for water mains. It costs less per service year and least to maintain. Its useful life is *more than a century* because of its effective resistance to rust. It is the one ferrous metal pipe for water and gas mains, and for sewer construction, that will not disintegrate from rust.

For further information address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.

CAST IRON PIPE

METHODS OF EVALUATING BIDS NOW IN USE BY ENGINEERS RATE THE USEFUL LIFE OF CAST IRON PIPE AT 100 YEARS

TRADEMARK REG.

Civil Engineer; Jun. Am. Soc. C.E.; 23; single; B.S. in C.E., Union College; 1 year surveying; 2 years maintenance and small construction work. Desires position in design or construction fields. Location in United States. Available immediately. D-4699.

Civil Engineer; Jun. Am. Soc. C.E.; 22; single; B.S. in civil engineering with high distinction, Worcester Polytechnic Institute, 1935. Limited experience. Temporarily employed as chief of office squad on hydrologic computations on Blackstone Valley flood control project. Would like to get into hydraulic or structural engineering. Location immaterial. Available immediately. D-4663.

Recent Graduate; Jun. Am. Soc. C.E.; 24; single; honor graduate in civil engineering, Oregon State College; member Tau Beta Pi and Sigma Tau. Practical experience in surveying; inspector in highway paving work; reinforced concrete construction; hydraulic model studies and research. Two weeks notice. Location immaterial. D-4738-362-A-4-San Francisco.

Civil Engineer; Jun. Am. Soc. C.E.; single; 23; B.S. (civil), University of Missouri, 1935; experience: 4 months as rodman, Missouri State Highway Dept.; 1 month as road contractor; 4 months as junior civil engineer, U. S. Forest Service; 3 1/2 months as instrumentman, state park survey. Desires position in any branch of civil engineering. Location immaterial; available immediately. D-4735.

Graduate Civil Engineer; Jun. Am. Soc. C.E.; B.S. in C.E. and C.E., 1935; single; one year experience in surveying and topographical drafting. Desires permanent position in civil engineering. Field work preferred. Location immaterial. Available immediately. D-4691.

Civil Engineer; Jun. Am. Soc. C.E.; 28; married; B.S. in C.E., University of Illinois, 1933; majored in structural engineering; 3 1/2 years on transmission line and substation surveys and erection; 2 1/2 years on surveys, design, and construction of erosion-control structures. Desires permanent position with opportunity in any branch of civil engineering. Prefers design or construction. Location immaterial. D-4757.

Graduate Civil Engineer; Jun. Am. Soc. C.E.; 26; single; 2 years computing and surveying; 1 1/2 years in sewerage and drainage design and construction; 1 year in building alteration and maintenance. Desires connection as an assistant engineer with some small town, village, or city. Alert, ambitious. D-4729.

Civil Engineer; Jun. Am. Soc. C.E.; 21; single; B.S. in C.E., Yale Engineering School, 1934; 1 1/2 years experience in highway location and construction surveying. Excellent references. Available immediately for position in any branch of civil engineering. D-4741.

Recent Graduate; Jun. Am. Soc. C.E.; Tau Beta Pi; 22; single; B.S.C.E., Rose Polytechnic Institute, 1935; 10 months drafting and surveying for railroad in Mississippi Valley; still employed but would like opportunity with a future in design or construction; sanitary engineering preferred. D-4767.

Civil Engineer; Jun. Am. Soc. C.E.; 21; single; B.S. in C.E., University of Pittsburgh, 1935; 5 months experience in highway surveying. Desires opportunity in any branch of civil engineering; prefers design and construction or surveying. Location immaterial. D-4772.

TEACHING

University Instructor; Assoc. M. Am. Soc. C.E.; desires a position as assistant professor with an opportunity to teach sanitary engineering; 13 years teaching experience; masters degree in sanitary engineering. B-7785.

Civil Engineer; Assoc. M. Am. Soc. C.E.; M.S. in C.E., Massachusetts Institute of Technology; also B.S. in C.E. and A.B. degrees; 32; married; 8 years experience in structural and sanitary engineering design and construction. Desires responsible teaching position. Location immaterial. C-8326.

RECENT BOOKS

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American Society of Heating and Ventilating Engineers Guide 1936 for Heating, Ventilating, Air Conditioning. New York, American Society of Heating and Ventilating Engineers, 1936. 1080 pp., illus., diagrs., charts, tables, 9 × 6 in., leather, $5.

This book comprises, in one volume, the technical data needed by engineers engaged in the design and operation of heating, ventilating, and air conditioning systems; a representative collection of manufacturers' data on equipment; and a directory of the members of the American Society of Heating and Ventilating Engineers. The new edition has been thoroughly revised and amplified. Chapters have been added on refrigeration, drying, motors and their control, railway air conditioning, and heat and fuel utilization. The volume is an exceedingly useful reference work.

American Society for Testing Materials. Proceedings of the 38th Annual Meeting held at Detroit, Mich., June 24–28, 1935. Vol. 35, Pts. 1 and 2. Philadelphia, American Society for Testing Materials, 1935. Vol. 1, 1488 pp.; Vol. 2, 769 pp., illus., diagrs., charts, tables, 9 × 6 in., leather, $15; in cloth, $12; in paper, $11.

The Proceedings for 1935 appear in two substantial volumes. Vol. 1 contains the reports of the standing committees of the association, the tentative standards that were issued or revised during 1935, and the tentative revisions of standards now under discussion. Vol. 2 contains the technical papers presented before the association.

Carpentry. By G. Townsend. Chicago, American Technical Society, 1936. 436 pp., illus., diagrs., 9 × 6 in., cloth, $2.

This book describes in a practical way correct methods of simple building construction. Framing, roof construction, general carpentry work, and exterior and interior finish are dealt with. The book is designed for home study and vocational schools.

Developing America's Waterways, Administration of the Inland Waterways Corporation. By M. E. Dimock. Chicago, University of Chicago Press, 1935. 123 pp., illus., charts, maps, tables, 9 × 5 in., cloth, $1.50.

This interesting book is a study in public administration, as exemplified by the Inland Waterways Corporation, and contains the findings of a survey of that organization, undertaken by the University of Chicago at the request of the Secretary of War. The specific questions surveyed were the economy and satisfactoriness of inland water transportation in comparison with other forms, and the efficiency of the organization and management of the corporation.

Elektroakustische Untersuchungen in Hallraumen. By H. Frei. Leipzig u. Vienna, Franz Deuticke, 1936. 99 pp., illus., diagrs., charts, tables, 9 × 6 in., 6.48 Austrian shillings; 4 German marks.

The first section of this work treats theoretically the problem of sound fields in closed rooms. The second section describes experimental investigations, carried on in a large auditorium, in which various methods of acoustical measurement were compared under different conditions of wall surface. The results were compared with tests on models, and the effects of wall recesses were studied. Finally, the physiological problems are discussed.

First Report on Viscosity and Plasticity, prepared by the Committee for the Study of Viscosity of the Academy of Sciences at Amsterdam. (Verhandelingen der Koninklijke Akademie van Wetenschappen te Amsterdam, Afdeeling Natuurkunde, eerste Sectie, Deel XV, No. 3.) Amsterdam, N. V. Noord-Hollandsche Uitgevers-Maatschappij, 1935. 256 pp., diagrs., charts, tables, 10 × 7 in., paper, fl. 10; bound, fl. 11.

The committee, which was formed in 1932, undertook to gather information upon the phenomena of viscous and plastic deformation as they appear in various domains of science and technology, to study the relations between these phenomena, to propose a suitable nomenclature, and to study methods of measurement. In this first report, the basic mechanical relations, the experimental investigation of flow properties, the measurement of viscosity, viscosity and plasticity from a technical point of view, the plasticity of metals and other crystalline substances, and viscosity effects in living protoplasm and muscles are discussed.

International Association for Bridge and Structural Engineering. Mémoires, Abhandlungen, Publications. Vol. 3, 1935. 438 pp., Zurich, Switzerland, A-G. Gebr. Leemann & Co., diagrs., charts, tables, 10 × 7 in., paper, 30 Swiss francs.

This third volume of publications contains 21 papers upon various theoretical and practical problems in steel and reinforced concrete construction. The four papers in the English language discuss the theory of arch deflection, the elastic stability of a pony truss, the analysis of Vierendeel trusses by successive approximations, and the application of soap-film studies to photoelastic stress determination. The remaining papers are in French or German, with very brief summaries in English.

Merkblatt für den Schallschutz im Wohnhaus. (DIN A 5.) Berlin, VDI-Verlag, 1935. 4 pp., paper, 0.10 rm.

This pamphlet lists a number of basic precautions for sound insulation which should be observed in the construction of dwellings. The recommendations are sponsored by the Committee for Noise Reduction of the Verein deutscher Ingenieure and the Deutsche Gesellschaft fuer Bauwesen.

The Next Hundred Years, the Unfinished Business of Science. By C. C. Furnas. Baltimore, Williams & Wilkins, 1936. 434 pp., 9 × 6 in., cloth, $3.

This is an interesting description of the present state of scientific knowledge of biology, chemistry, and physics, and of the social consequences of their development, intended for the general reader. The attitude of the author is a critical one, and he emphasizes what science hopes to do, rather than what has been done.

Petroleum Refinery Engineering. By W. L. Nelson. New York and London, McGraw-Hill Book Co., 1936. 647 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $6.

This book, which is mainly concerned with the fundamentals of engineering design and processing, is a valuable addition to the literature of refining and a useful supplement to other books on that subject. The practical phases of engineering work are emphasized, and the book is intended to aid in clarifying the questions of detail that arise during plant operation and to encourage fuller use of the principles of chemical engineering. Useful select bibliographies accompany the various chapters.

Plain Concrete. By E. E. Bauer. 2 ed. New York and London, McGraw-Hill Book Co., 1936. 364 pp., illus., diagrs., charts tables, 9 × 6 in., cloth, $4.

This is a combination textbook and laboratory manual, intended for an undergraduate course. The manufacture of cement, the selection and preparation of the raw materials, the proportioning, making, and placing of concrete are discussed, as are the questions of inspection, testing, and specifications. The laboratory section gives instructions for the standard methods for the usual tests. The new edition has been largely rewritten.

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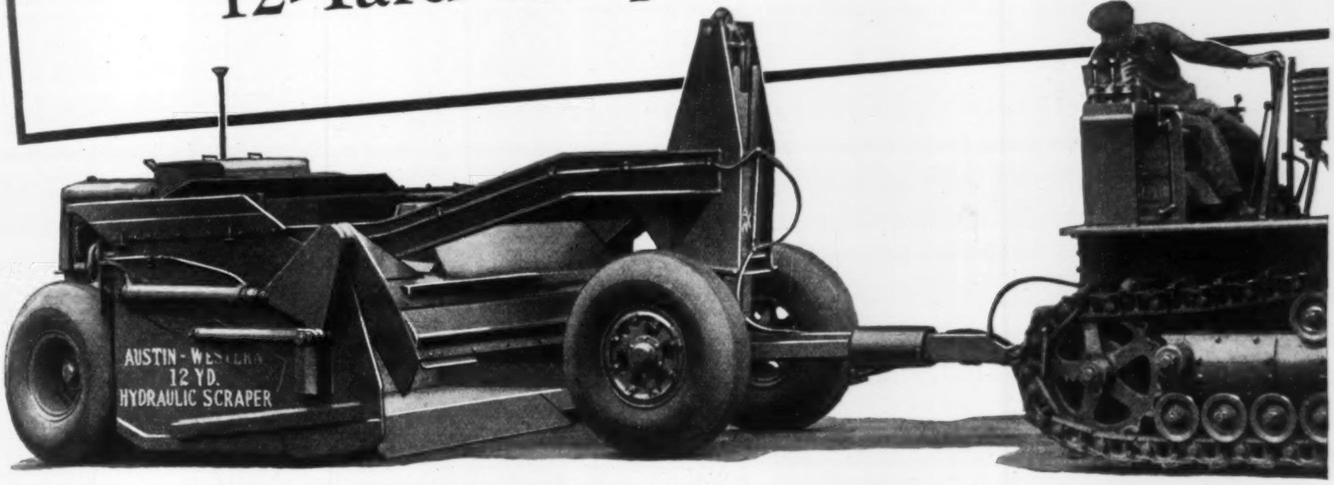

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BRIDGES

Bascule, Vancouver. Superstructure of Reconstructed Second Narrows Bridge, Vancouver, P. L. Pratley. *Eng. J.*, vol. 19, no. 1, Jan. 1936, pp. 3–23. Design and construction of long warren-truss steel bridge, including central 2-leaf bascule span 282 ft long; details of mechanism and operation of bascule span. Before Eng. Inst. Canada.

Design. Statics of Bridge Design, G. Dunn. *Concrete & Constr. Eng.*, vol. 29, no. 12, Dec. 1934, pp. 732–744, and vol. 30, no. 3, Mar. 1935, pp. 175–191, 1 supp. sheet. December: Portal frame bridges; formulas for hinged portal frames. March: Combined thrust and bending; calculation of rectangular arch sections, reinforced equally on two faces. (Continuation of serial.)

Highway, Approaches. Underpinning Camden Approach of Delaware River Bridge, E. R. Albertson. *Eng. News-Rec.*, vol. 116, no. 1, Jan. 2, 1936, pp. 12–14. Viaduct columns and retaining walls, intercepted by Philadelphia subway construction underneath, are given new footings and transferred to subway roof; picking up bridge columns.

Lift, Cape Cod Canal. Lift Span Over Cape Cod Canal Sets New Precedents. *Eng. News-Rec.*, vol. 116, no. 5, Jan. 30, 1936, pp. 145–151. Symposium on design and construction of railroad lift bridge at Buzzards Bay, Mass., with record span of 544 ft; Roller Bearing Design for 544-Ft Lift Span, E. L. Macdonald; Erecting 544-Ft Lift Bridge, W. A. Ellis.

Steel. Better Bridges Require Less Maintenance, C. E. Webb. *Ry. Eng. & Maintenance*, vol. 32, no. 1, pt. 1, Jan. 1936, pp. 27–28. Review of advances in steel-bridge practices resulting from better materials, improved methods, and modern equipment; how refinements in detailing result in longer life and reduce maintenance expenditures. Before Am. Ry. Bridge and Bldg. Assn.

Suspension, Anchoring. Self-Anchored Suspension Bridge, H. Mullins. *Eng. News-Rec.*, vol. 116, no. 2, Jan. 9, 1936, pp. 45–49. Review of its history and analysis of its characteristics, indicating that it has advantages that recommend it for wider use than it has enjoyed; use in United States; list of 13 self-anchored suspension bridges in the world; disadvantages; structural details.

Suspension, Golden Gate. Bridging the Golden Gate, J. Reed. *West Machy. & Steel World*, vol. 26, no. 12, Dec. 1935, pp. 369–371. Brief log of construction progress from start of construction to date.

Suspension, Piers. Construction of Substructure of Island of Orelans Bridge—I and II, P. L. Pratley. *Can. Engr.*, vol. 68, nos. 15 and 17, Apr. 9, 1935, pp. 5–9, and Apr. 23, pp. 9–12. Use of caissons and cofferdams in construction of piers for suspension bridge having main span of 1,059 ft; anchor piers built by stages in tidal waters; wooden model constructed for guidance of engineers and contractors.

BUILDINGS

Soundproofing. Experience in Sound Insulation, C. Moeller. *Roy. Inst. British Architects—J.*, vol. 43, 3rd series, no. 6, Jan. 18, 1936, pp. 291–298. Noise and vibration; disturbing effect of noise; vibration nuisance; heat insulation vs. sound insulation; technical methods of noise and vibration reduction; reducing noise at its source; impact noises; installation noises; machine noise; noise in offices and public buildings; sound borne by air; sound and vibration borne by structures.

CITY AND REGIONAL PLANNING

Slums. Slum Clearance as Management Problem, J. J. Furia. *Taylor Soc. & Soc. Indus. Engrs.—Bul.*, vol. 1, no. 7, Nov. 1935, pp. 225–232. Some characteristics of slum properties; slum clearance and industrial recovery; slum clearance via "housing dole" or scientific management; Costa-Furia mass production construction systems; slum clearance and city planning; capital structure and financial operations; estimate of operating profit. Before Sixth Int. Congress for Sci. Mgmt.

Viaducts, Baltimore. Orleans Street Viaduct, Baltimore, J. L. Harrison. *Roads & Streets*, vol. 78, no. 5, May 1935, pp. 163–166. Function of viaduct 2,000 ft long, to cost $1,000,000; through-traffic problem and street situation in Baltimore; tying city streets and country roads; static responsibility for through traffic.

CONCRETE

Construction. Practical Notes on Concrete Making and Placing with Particular Reference to Bridge Work, G. Dunn and A. W. Legat. *Concrete & Constr. Eng.*, vol. 30, no. 4, Apr. 1935, pp. 244–262. Proper characteristics of cement, sand, coarse aggregate, water, test cubes, proportioning and mixing; transportation and placing; curing; remedying defects.

Design, Great Britain. New Code Applied to Design—V, C. E. Reynolds. *Concrete & Constr. Eng.*, vol. 29, no. 12, Dec. 1934, pp. 759–772. Upper floors; alternative superimposed loads; design of floor slabs; design of floor beams.

Mixing. Design of Concrete Mixes for Mississippi River Dams, R. P. Johnson. *Eng. News-Rec.*, vol. 115, no. 22, Nov. 28, 1935, pp. 743–746. Use of remolding apparatus in crowded work of designing concrete mixes for seven simultaneous operations involving 430,000 cu yd of concrete; curves of optimum sand percentages required for various gravel mixtures and water-cement ratios; relationship between gravel grading and cement requirements in concrete having definite degrees of workability.

DAMS

Boulder Dam Project. Boulder Dam: Past Construction and Work Yet to Be Done. *Eng. News-Rec.*, vol. 115, no. 26, Dec. 26, 1935, pp. 878–883. Review of work accomplished since beginning of construction in 1931 and outline of work remaining to be done on power plant and auxiliaries.

Concrete Gravity, Construction. Small Dams—How to Build Them. *Concrete*, vol. 43, no. 9, Sept. 1935, pp. 6–8. Illustrated construction details of concrete-gravity dam; foundation problems and how to meet them; notes on spillways and outlets.

Earth, California. Earth-Fill Dam to Be Built by Method of Soil-Compaction Control. *Eng. News-Rec.*, vol. 115, no. 24, Dec. 12, 1935, p. 807. Features of Cajalco Dam, near Riverside, Calif.; 240 ft ultimate height; now in course of construction; cost estimated at about $5,000,000.

Earth, Germany. Die Staubeckenanlage Ottmachau, P. Vollmer. *Zentralblatt der Bauverwaltung*, vol. 55, no. 3, Jan. 16, 1935, pp. 37–44. Design and construction of Ottmachau reservoir and of earth dam 6.5 km long, 20 m maximum height, for regulating flow of Oder River and hydro-electric power development of 4,000 kw; description of wasteway over 6 km long; details of power plant, outlet valves, etc.

Earth, Great Britain. Construction of Burnhope Reservoir, Wearhead, Durham, S. S. Allderidge. *Surveyor*, vol. 87, nos. 2265 and 2266, June 21, 1935, pp. 765–766, (discussion) June 28, pp. 821–824. Construction of earth-fill dam of 131-ft maximum height, with volume of 1,600,000 cu yd; details of concrete corewall and puddle core. Before Instn. Water Engrs.

Earth, Montana. Fort Peck Dam, Progress of Construction, C. H. Chorpening. *Military Eng.*, vol. 27, no. 151, Jan.–Feb., 1935, pp. 36–41. Progress report on construction of earth dam over 9,000 ft long, 242 ft maximum height; communications; floating plant and power; town of Fort Peck; tunnel construction; spillway.

Ice Pressure. Einwirkon des Eises bei Talsperranlagen, A. Haerry. *Wasser-u. Energiewirtschaft*, vol. 27, no. 2, Feb. 1935, pp. 23–26. Review of studies on mechanical effect of pressure of ice on dams including German, Italian, and French specifications for its calculation, leading to conclusion that effect of ice pressure is probably exaggerated.

Spillways, Construction. Tough Shale Bored and Sawed for Fort Peck Spillway Gate. *Eng. News-Rec.*, vol. 116, no. 2, Jan. 9, 1936, pp. 37–39. Spillway-gate structure consisting of 17 piers set on curved line, between which are suspended sixteen 40 by 25-ft stoney gates, with provision for emergency stoplog closure; novel 5-ft augers boring deep holes for gate structure foundation piers; adapted coal-sawing rigs cut out cut-off trench and slash 4 ft of overburden into ribbons for easy removal.

Weirs, Discharge. New Flow-Formula for Sharp-Crested Weirs, M. W. Woods. *Instn. Engrs. Australia—J.*, vol. 7, no. 1, Jan. 1935, pp. 1–9. Results of experimental study at University of Tasmania leading to derivation of original empirical formula; distribution of pressure along base of channel approaching weir.

Welding. Construction and Maintenance Problems Solved by Welding, A. F. Davis. *Am Welding Soc.—J.*, vol. 15, no. 1, Jan. 1936, pp. 2–5. Successful repair jobs made on power shovel, drag-line bucket, and welded pipe line; arc welding aids construction of Fort Peck Dam; new drop pit table for locomotive maintenance announced by Shaw Box Crane Hoist Company, etc.

FLOW OF FLUIDS

Spillways, Flow. Recent Studies on Flow Conditions in Steep Chutes, E. W. Lane. *Eng. News-Rec.*, vol. 116, no. 1, Jan. 2, 1936, pp. 5–7. Results of theoretical and experimental studies made in connection with design of spillway of Cle Elum Dam and tunnels of Boulder Dam; formation of boundary layer; centrifugal forces at vertical curves; effects of non-uniform width; distribution of velocities in shooting jet.

FOUNDATIONS

Buildings. Problems in Design of Foundations, W. E. Simpson. *Refiner*, vol. 14, no. 9, Sept. 1935, pp. 426–431. Notes on foundation engineering problems, with special reference to conditions in some parts of Texas, where plastic clays cause trouble; action of soils; disturbance causes change in character of soils; time settlement curves; mat foundation; swelling of soils.

Ground-Water Control. Pumping "In a Big Way" at Bonneville Dam. *Contractors & Engrs. Monthly*, vol. 30, no. 3, Mar. 1935, pp. 9, 22, and 27. Description of battery of pumps, with capacity of 90,000 gal per min, used for unwatering of power house site; determining pumping requirements; measuring leakage.

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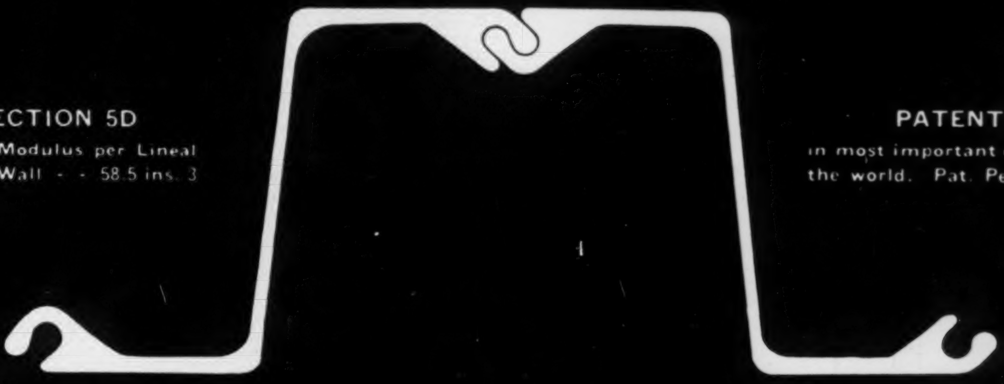

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Piles, Concrete, Cost. Large Reinforced Concrete Piles Prove More Economical. *Ry. Age*, vol. 99, no. 24, Dec. 14, 1935, pp. 782–786. How Missouri Pacific has applied 5,000 reinforced concrete piles after demonstrating special advantages of three-pile bent.

Piles, Concrete, Driving. Behavior of Reinforced-Concrete Piles During Driving, W. H. Glanville, G. Grime, and W. W. Davies. *Machy. Market*, nos. 1829, 1830, 1831, and 1832, Nov. 22, 1935, pp. 985–986; Nov. 29, pp. 1007–1009; Dec. 6, pp. 1031–1032; and Dec. 13, pp. 1051–1053. Investigation into behavior of piles, carried out at Building Research Station, as direct result of troubles experienced while driving piles through hard stratum to set in firm ground below. Before Instn. Civ. Engrs.

Piles, Concrete, Testing. Cast-in-Place Short Piles Show High Test Results, F. J. Converse. *Eng. News-Rec.*, vol. 115, no. 25, Dec. 19, 1935, pp. 842–844. Results of Los Angeles tests of concrete piles, cast-in-place, 20 ft by 14 ft long, providing economical foundations for low and medium-height buildings in extremely loose and friable soils found in many parts of Los Angeles basin; settlement of cast-in-place concrete pile under load; load settlement in terms of surface area of concrete piles under different conditions of soil saturation.

Piles, Steel, Removal. Pile Extractor Aids on 125-Ton Pull. *Eng. News-Rec.*, vol. 115, no. 24, Dec. 12, 1935, p. 824. Special equipment employed in removing sheet piling used for cofferdams on East Bay crossing of San Francisco–Oakland Bay Bridge.

Piles, Wooden, Preservation. Pile-Treating Specifications for Using Metallic Salts. *Eng. News-Rec.*, vol. 115, no. 24, Dec. 12, 1935, p. 825. Use of arsenous oxide, hydrous copper sulfate, and hydrous zinc sulfate in treating piles for highway bridges, built by Oregon State Highway Commission.

Testing, New Jersey. New Jersey Approach Borings. Midtown Hudson Tunnel. Port N. Y. Authority—Contract, MHT-1D, Dec. 1935, 78 pp. Specifications for making 70 land borings for determination of nature of material overlying rock and elevation and character of rock itself.

HYDRO-ELECTRIC POWER PLANTS

Developments. Hydro-Electric Power and Irrigation Schemes in 1935. *Engineer*, vol. 161, no. 4173, Jan. 3, 1936, pp. 12–14, supp. plate. Review of some developments, including Hume Dam, Australia; Colorado River; Waitaki Dam, New Zealand; El Kansera Dam, Morocco; Cardano power plant, Italy.

HYDROLOGY, METEOROLOGY, AND SEISMOGRAPHY

Rain and Rainfall, Periodicity. Important Rain Cycle of 152 Years. H. P. Gillette. *Roads & Streets*, vol. 78, no. 3, Mar. 1935, pp. 110–112. Review of recently discovered indications of long rainfall cycles.

INLAND WATERWAYS

Canals, Siphons. Der Okerdueker unter dem Mittellandkanal bei Braunschweig, Maaske and Hampe. *Bautechnik*, vol. 13, no. 12, Mar. 19, 1935, pp. 133–146. Design and construction of triple siphon crossing conveying water of Oker River under and across Mittelland Canal in Germany; consists of three heavily reinforced-concrete ducts 5.6 m by 5.64 m each, about 75 m long; controlling ground water during construction; concrete testing.

Ice Control, Blasting. Blasting Ice Jam to Save Railway Bridge, G. L. Campbell. *Eng. & Contract Rec.*, vol. 49, no. 16, Apr. 17, 1935, pp. 333–336. Procedure adopted to open channel in St. Francis River and relieve ice blockade that extended for nearly 4 miles.

IRRIGATION

Australia. Water Conservation and Irrigation Works in Victoria, R. H. Horsfield. *Instn. Engrs. Australia—J.*, vol 7, no. 1, Jan. 1935, pp. 10–23. Activities of State Rivers and Water Supply Commission of Victoria; special engineering features of Goulburn weir, Waranga reservoir; earthen dams—Coliban, Waranga, and Pykes Creek reservoirs; rock-fill dams—Melton and Eildon reservoirs; channel structures; channel lining; river protection; drainage of irrigated land.

PORTS AND MARITIME STRUCTURES

Marine Borers. Protection Against Marine Borer Attacks, W. G. Atwood. *Mar. News*, vol. 22, nos. 6 and 7, Nov. 1935, pp. 22–23, and Dec., p. 25. Problem of protecting structures, both fixed and floating, against attack of marine borers.

Sea Walls, Concrete. Les nouveaux quais de Bône et de Djibouti, L. Ravier. *Travaux*, vol. 18, no. 23, Nov. 1934, pp. 471–476; see also English abstract in *Eng. News-Rec.*, vol. 115, no. 4, July 25, 1935, pp. 110–111. New type sea walls, up to 41 ft in height, at Djibouti in French Somaliland and at Bone in Algeria, consisting of from three to five tiers of huge precast plain concrete blocks with sloping backfill of rock in contact with only two or three of tiers.

Steel Corrosion, Sea Water. Marine Corrosion, J. W. Donaldson. *Metallurgia*, vol. 12, no. 70, Aug. 1935, pp. 117–118. Review of investigations relating to problem of ensuring life of any structures subjected to action of sea water; with special reference to steel plates.

Stockholm. Staedtebauliche Probleme und Umgestaltungen in Stockholm—II, S. Vinberg and C. Semler. *Bauingenieur*, vol. 16, nos. 9/10, Mar. 1, 1935, pp. 96–101. Stockholm port extensions and improvements; new cargo-handling equipment; description of petroleum docks.

ROADS AND STREETS

Asphalt. Modern Equipment for Construction of Asphaltic Road Surfaces, B. E. Gray. *Eng. & Contract Rec.*, vol. 49, nos. 17 and 19, Apr. 24, 1935, pp. 356–358, and May 8, pp. 391–392. April 24: Descriptions of machinery now available for production of uniform, high quality, rigidly controlled pavements of asphaltic type; surface treatments; road-mix surfaces; penetration macadam. May 8: Plant mixes block pavements. Before Am. Road Bldrs. Assn.

Concrete. Asphalt als Deckschicht auf Betonbelaegen, B. Wehner. *Bitumen*, vol. 5, no. 6, July 1935, pp. 113–119. Asphalt as protective coating on concrete; old concrete roads with cracks, spalling, etc., are improved by covering with asphaltic concrete, asphalt-impregnated macadam, road-mixed material, or sheet asphalt; American, English, and Italian practices discussed.

Concrete, Design. Structural Design of Concrete Pavements, L. W. Teller and E. C. Sutherland. *Pub. Roads*, vol. 16, no. 10, Dec. 1935, pp. 201–221. Part 3: Study of concrete pavement cross sections; development of thickened-edge pavement design; factors affecting design; program of load testing; formulas for calculating load stresses; deflection and stress variation; maximum deflection and maximum stress diagrams; effects of multiple-wheel loadings; combined load and temperature warping stresses; test results applied to design of balanced cross section.

Concrete, Recent Progress. Recent Developments in Concrete Pavement Design and Construction, W. S. Barker. *Roads & Streets*, vol. 78, no. 1, Jan. 1935, pp. 7–10. Review of 1934 progress; vibration; new curing mediums; proportioning; joints; soil studies; advances in design; joint fillers; dowels; permanent traffic lines; cement-bound macadam.

Concrete, Strength. Flexural Strength Predetermined, E. W. Bauman. *Concrete*, vol. 43, nos. 11 and 12, Nov. 1935, pp. 9–10, and Dec., pp. 11–15, and 20. Proportioning concrete to provide definite flexural strength for pavement construction; factors controlling flexural strength; procedure in Tennessee; test methods.

Concrete, Winter Paving. Detroit Contributes to Winter Paving Experience. *Roads & Streets*, vol. 78, no. 1, Jan. 1935, pp. 1–3. Experience of Detroit Street Railways in winter construction of concrete road; placing of pavement slab at temperatures as low as minus 4 F; use of sodium chloride in thawing of 1 in. of subgrade which was frozen for 24 in.; core test data.

Construction. Highway Reconstruction Through Earthquake Shattered Mountains, T. H. F. Nevins. *Roads & Streets*, vol. 78, no. 4, Apr. 1935, pp. 119–124. Review of practice in New Zealand; reconstruction undertaken as relief measure; damage to bridges; causes of slips; condition of Westport-Karamea highway; conditions on Westport-Nelson highway; treatment of slips; labor organization.

Construction, Management. Planned Management. *Eng. News-Rec.*, vol. 116, no. 3, Jan. 16, 1936, pp. 80–91. Symposium including following papers: Designing an Organization, J. L. Harrison; Increased Hauling Efficiency, T. W. Allen; Materials Yard Practice, A. P. Anderson.

Construction, Ontario. Recent Developments in Highway Construction in Ontario, J. E. Jackson. *Can Engr.*, vol. 68, no. 21, May 21, 1935, pp. 9–14. Gravel-mulch roads; standard cross section of 20-ft concrete pavement; highways surveyed in 1934; Trans-Canada highway; design of roadway on curves; stabilized gravel roads; low-cost road surfaces. Part of report of Committee on Engineering Roads and Pavements presented before Ontario Land Surveyors Assn.

Design. Method of Designing Non-Rigid Highway Surfaces, G. E. Hawthorn. *Univ. Washington—Experiment Station—Bul.*, no. 83, Aug. 1935, 40 pp. Derivation of theoretical formulas for thickness of surfacing, based on wheel load, area of wheel contact, shearing angles in surfacing, and supporting strength of subgrade; formula for determining bearing power of subgrade soil, based on loaded area and cohesion and internal friction of soil particles on straight-line principle of stress distribution used by C. Terzaghi and others.

Ethiopia. Road Building in Western Abyssinia, G. T. Eve. *Min. Mag.*, vol. 53, no. 5, Nov. 1935, pp. 277–282. Notes on construction of 115 miles of motor road from Gambeila to platinum mines on plateau.

Expressways. Non-Stop Express Highway Being Built in St Louis, W. W. Horner. *Eng. News-Rec.*, vol. 115, no. 25, Dec. 19, 1935, pp. 846–849. Design and construction of 3-mile, 5-lane road without grade crossings giving access to central business district on new right-of-way; roadway structures; pedestrian overpass and equestrian underpass.

Freeways. "Limited Motorways," or "Freeways," F. P. Clark. *Am. City*, vol. 51, no. 1, Jan. 1936, pp. 53–56. Advantages and design of modern freeways characterized by: separation of opposing lines of traffic by center park strip; grade-separation or rotary-traffic design of intersections; control of border land by state highway department; provision for pedestrian paths; banking and visibility.

Highway Accidents. Road Design and Accident Statistics, G. T. Bennett. *Surveyor*, vol. 87, no. 2250, Mar. 8, 1935, pp. 341–343. Removal of danger spots; faulty layout and defective surfaces; Oxfordshire investigation; sites of accidents; program of improvements; censuses of traffic; comparison of accident statistics.

Highway Engineering, Construction Research. Road-Construction Research in United States. *Engineering*, vol. 141, no. 3651, Jan. 3, 1936, pp. 23–25. Review of report dealing with 14th annual meeting of Highway Research Board, held in Washington, D.C., in December 1934; studies of tractive resistance, road design, wheel-load distribution, and stresses in roads; high-elastic-limit reinforcement steel, and effects of calcium chloride on cement.

Highway Engineering, Physical Research. Physical Research by Bureau of Public Roads. *Roads & Streets*, vol. 78, no. 2, Feb. 1935, pp. 72–76. Current investigations of U. S. Bureau of Public Roads; motor-vehicle impact; subsurface explorations; highway-bridges; measurement of road-surface roughness; concrete pavement design; effects of freezing and thawing; rattler and soundness tests; curing methods; joint fillers; protective surface treatments for concrete; concrete mixtures; bituminous paving mixtures; low-cost bituminous surfaces; weathering tests on bituminous mixtures.

Highway Systems, Pan-American. Existing Roads to Be Used in Proposed U.S.–Alaska Highway. *Eng. News-Rec.*, vol. 116, no. 5, Jan. 30, 1936, p. 152. Features of proposed route, which would extend 2,200 miles from Vancouver to Fairbanks, forming link in proposed Pan-American Highway system, extending from Alaska to Central America.

Macadam. Practical Methods of Constructing Cement-Bound Macadam Pavements. *Eng. & Contract Rec.*, vol. 49, no. 12, Mar. 20, 1935, pp. 228–231. Summary of information compiled by Portland Cement Assn. on cement grouting, equipment, subgrade, spreading coarse aggregate, compacting coarse aggregate, final compaction, finishing, curing, and approximate quantities of materials required for cement-bound macadam roads.

Maintenance and Repair, Resurfacing. Overcoming Handicaps in Street Resurfacing, F. J. McDevitt. *Am. City*, vol. 51, no. 1, Jan. 1936, pp. 46–48. Outline of practice in St. Louis; use of cheap hot and cold mixes with local aggregate; making ore-mix with asphalt emulsion; alternates for widening and costs.

Maintenance and Repair, Soil Erosion. Highway Cut and Fill Slopes Treated to Check Soil Erosion. *Eng. News-Rec.*, vol. 116, no. 2, Jan. 9, 1936, pp. 43–44. Practice of Tennessee Valley Authority; banks fertilized, seeded, and mulched with brush or straw to prevent soil washing; masonry check dams.

Railroad Crossings, Signals and Signaling. Street Traffic Signals Controlled by Trains. *Ry. Signaling*, vol. 29, no. 2, Feb. 1936, pp. 74–75. Automatic controls installed by Southern Pacific, at Los Angeles, for setting street traffic signals in stop position upon approach of train.

Cedar Point Road, Lucas County, Ohio. Tarvia-built in 1913 when automobiles were as rare as horse-drawn vehicles are today.

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Twenty-three years of uninterrupted service is not an exceptional Tarvia performance record. Highway officials all over the country have had similar experiences with low-cost Tarvia pavement. They know that only the simplest and most inexpensive maintenance is needed to make a Tarvia road last indefinitely—always smooth, easy-riding and skid-safe. The Tarvia field man will give you details. Phone, wire or write our nearest office.

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Resurfacing. Resurfacing Old Pavements with Concrete. *Can. Engr.*, vol. 68, no. 15, Apr. 9, 1935, pp. 13–14. Design of reinforced concrete pavement to cover thin slabs or surfaces that are worn out; construction of expansion joints; provision for widening road; bond between new and old concrete.

Standards. Road-Structure Standards. *Eng. News-Rec.*, vol. 116, no. 3, Jan. 16, 1936, pp. 72–79. Symposium including following papers: Brick Pavement Processes, C. G. Wahl; Improved Quality in Concrete, W. G. Sloan; Bituminous-Macadam Practice, F. T. McAvoy; Secondary Road Surfaces, R. L. Morrison.

Strip. Strip Roads, S. Chandler. *Surveyor*, vol. 87, no. 2264, June 14, 1935, pp. 749–750. Southern Rhodesia practice of building two asphalt or concrete strips, 2 ft wide, instead of solid roadway 18 ft wide; specifications for concrete and asphalt strips; costs; comparative maintenance costs.

Unemployment Relief, Costs. Economic and Statistical Analysis of Highway-Construction Expenditures by Bureau of Public Roads, C. F. Rogers, R. E. Hertel, and R. W. Kruser. U. S. Dept. Agriculture, June 1935, 56 pp., price 15 cents. Highway construction as employment measure during depression; distribution of highway expenditures to basic industries; payments to cement industry; distribution of expenditures for consumer goods; reinvestment of interest and margin; employment created; business from $100,000,000 highway expenditure. Bibliography.

Unemployment Relief, Roadbuilding. Emergency Roadbuilding, T. H. MacDonald. *Eng. News-Rec.*, vol. 116, no. 5, Jan. 30, 1936, pp. 163–166. Official appraisal of values created through emergency highway construction work of five depression years in terms of mileage; kind of road built and comparative cost; summary status of highway programs from $400,000,000 Public Works Fund and $200,000,000 Hayden-Cartwright Act Fund. Before Am. Road Builders Assn.

United States. Review of Current Highway Results and Future Policies, T. H. MacDonald. *Roads & Streets*, vol. 78, no. 2, Feb. 1935, pp. 67–71. Year's contribution to employment; 40-hr week for road work; new roadways provided; types of improvements classified; footpaths and roadside improvements; need for grade-crossing elimination; planning future programs; Indiana traffic survey; improvement of secondary roads; modernization of municipal highways. Before Am. Assn. State Highway Officials.

SEWERAGE AND SEWAGE DISPOSAL

Canals, Sanitation. Sanitary Situation in Sections of Old Welland Canal. *Can Engr.*, vol. 68, no. 24, June 11, 1935, pp. 5–11, and 14. Abstract of report by Sanitary Engineering Division of Ontario Department of Health on sanitary conditions affecting St. Catharines, Thorold, Merritton, and Port Dalhousie; review of previous investigations; flow in canal; waste outlets into canal; what municipalities and industries are doing; dewatering of old canal.

Chlorination. Multiplication of Total Bacteria and B. Coli After Sewage Chlorination, W. Rudolfs and H. W. Gehm. *Sewage Works J.*, vol. 7, no. 6, Nov. 1935, pp. 991–996. Experimental study made at Division of Water and Sewage Research of New Jersey Agricultural Experiment Station, leading to conclusion that bacterial removal from sewage varies with quantity of chlorine added, contact time, and types of substances present; reduction in numbers of organisms followed by great increases after incubation, not proportional to chlorine added. Bibliography.

Great Britain. Sewage-Treatment Trends in England, K. Imhoff. *Eng. News-Rec.*, vol. 116, no. 1, Jan. 2, 1936, pp. 8–11. Critique of activities; changes of procedure and their relation to developments in United States; screens and grit chambers; settling and stormwater tanks; sludge digestion in two stages; sludge drying; chemical treatment; trickling filters favored; experience with activated sludge; sludge reaeration; broad irrigations.

Odor Control. Interesting Experiment in Reducing Plant Odors, W. J. Schiverea. *Mun. Sanitation*, vol. 7, no. 1, Jan. 1936, pp. 26 and 28. Ortho-dichlor-benzene used to destroy offensive odors at Freehold, N.J., separate sludge digestion plant. Abstract of paper before New Jersey Health and Sanitary Assn.

Plants, Cleveland, Ohio. Cleveland Adds New Plant to Its Sewage-Disposal Facilities. *Eng. News-Rec.*, vol. 116, no. 2, Jan. 9, 1936, pp. 52–58. Description of 123-mgd activated-sludge plant now under construction in Easterly District of Cleveland, Ohio; many original features, including grease separators and novel arrangement of sludge-digestion units located 13 miles from plant site; determining capacity of plant; degree of treatment; aeration tanks; preliminary treatment; sludge-settling tanks.

Plants, Corrosion. Deterioration of Metal Surfaces at Sewage Plants. *Mun. Sanitation*, vol. 6, no. 2, Feb. 1935, pp. 54–56. Discussion by superintendents of their observations on corrosion of metal surfaces exposed to hydrogen sulfide and moisture; effectiveness of remedies employed.

Plants, Design. Trends in Sewage Plant Design, H. R. F. Helland. *Mun. Sanitation*, vol. 6, no. 3, Mar. 1935, pp. 75–77. Review of progress; sedimentation of sewage; trickling filters and Dunbar beds; chemical precipitation plants; mechanical equipment; licensing of operators. Before Southwestern Waters Works Assn.

Plants, Germany. Sewage Treatment System of City of Munich. *Engineering*, vol. 140, no. 3650, Dec. 27, 1935, pp. 679–682, supp. plates. Tanks divided into 16 units, each consisting of two sedimentation tanks, one sludge digestion tank, and effluent chamber; sewage divided equally among 16 units; gas pumping station provided with three compressors with daily capacity of 22,000 cu. m; gas delivered to city gas works at Monsach, is mixed with coal gas; whole plant is largely automatic; particulars of fish farm; data on revenue from fish, ducklings, sludge, and gas.

Plants, Milwaukee, Wis. Milwaukee Extends Facilities for Sewage Treatment, D. W. Townsend. *Eng. News-Rec.*, vol. 116, no. 5, Jan. 30, 1936, pp. 153–157. Description of new extension by which present plant capacity of 85 mgd increased to 155 mgd by addition of aeration units, sludge-settling tanks, and appurtenant equipment costing $3,000,000; land reclaimed from Lake Michigan to enlarge site of Milwaukee plant; sedimentation tanks; channels and operating galleries; air piping and blowers; sludge pumping and control.

Plants, Operation, Salem, Mass. Disposal of Sewage from South Essex Sewerage District, Salem, Massachusetts, E. Wright. *Sewage Works J.*, vol. 7, no. 4, July 1935, pp. 663–672. Operating results and problems of sewerage district having total maximum capacity of 40 mgd; harbor currents; analyses of sea water; character of sewage; grease balls; experimental work; improvements recommended. Before New England Sewage Works Assn.

Pumps. Experiences with Sewage and Sludge Pumping Equipment, R. F. Hunger. *Sewage Works J.*, vol. 7, no. 6, Nov. 1935, pp. 1109–1123, (discussion) 1123–1127. Practical experience with vertical submerged pumps, vertical non-submerged pumps, submerged horizontal pumps in dry well, and horizontal self-priming pumps; variable speed pumping; testing new pump installations; centrifugal sludge pumps.

Sewers, Accident Prevention. Prevention of Accidents in Sewers. *Surveyor*, vol. 87, no. 2250, Mar. 8, 1935, pp. 361–362. Review of safety apparatus and measures adopted by several boroughs of London.

Sludge. Disposal of Sewage Solids, F. W. Mohlman. *Sewage Works J.*, vol. 7, no. 6, Nov. 1935, pp. 979–990. Review of recent progress in sludge disposal; types of sewage sludge; sludge disposal investigations by Sanitary District of Chicago; concurrent developments elsewhere; use of centrifugal machines; other dewatering devices; drying and incineration; disposal of screenings and grit. Before New York and New England Sewage Works Assns.

STRUCTURAL ENGINEERING

Beams, Continuous. Influence Lines for Beams Continuous Over Three Spans, R. J. Cornish and E. Jones. *Structural Engr.*, vol. 14, (new series) no. 1, Jan. 1936, pp. 2–17. Theoretical mathematical discussion; influence lines for moments over supports and for bending moment at any point of spans; effect of fixing moments; influence lines for reactions at supports, and for shear forces; beam with built-in ends; effect of stiffness of columns; uniformly distributed load; magnitude of effect of column stiffness.

Retaining Walls, Earth Pressures. Earth-Pressure on Flexible Walls, J. P. R. N. Stroyer. *Instn. Civ. Engrs.—J.*, no. 1, Nov. 1935, pp. 94–139, 1 supp. plate. Review of recent theoretical and experimental studies, including author's original laboratory experiments; fixed and movable walls; steel plates; artificial slides; state of flux; stability of flux condition; balancing; vibration; influence of wall thickness; rupture planes.

Trusses, Vierendeel. Open-Frame Girder, E. H. Bateman. *Instn. Civ. Engrs.—J.*, no. 1, Nov. 1935, pp. 67–93. Mathematical theory of design of vierendeel trusses; detailed analysis of girder of uniform section with parallel chords, divided into panels of equal stiffness, but with web-posts that may be of different stiffnesses from chord-sections; numerical results and influence lines for girders of six, eight, and ten panels.

SURVEYING

Aerial Photography, Mapping. Using Aerial Photographs for Topographic Mapping, H. E. Banks. *Eng. News-Rec.*, vol. 116, no. 1, Jan. 2, 1936, pp. 16–17. Preparation of topographical map of Fairfield, Conn., by using available aerial survey as base map for plotting contours and aiding in planetable work; accuracy of traverse work; establishing benchmarks; cost.

WATER RESOURCES

United States. Quality of Water and Drought of 1934; W. W. Brush. *Water Works Eng.*, vol. 88, nos. 45 and 46, Mar. 6, 1935, pp. 231–234, and Mar. 20, pp. 280–282. Abstract from report of Water Planning Committee of National Resources Board; quality of surface and ground waters; dissolved mineral matter; relation of dissolved mineral matter to run-off; pollution; industrial wastes; mine drainage; great drought of 1934; sources for public water supply; trend toward abandoning polluted sources; concentration of population; standards of water quality; water consumption; ownership of water supply systems.

WATER TREATMENT

Analysis, Mathematical. Mathematische Darstellung des Mischungsproblems, O. Wilski. *Gas- u. Wasserfach*, vol. 78, no. 12, Mar. 23, 1935, pp. 207–210. Mathematical analysis of effect of mixing treated with untreated water.

Analysis, Tests. Outline of Water Analysis—IV, J. J. Hinman, Jr. *Water Works Eng.*, vol. 88, no. 5, Mar. 6, 1935, pp. 226–230. Tests using indicator solutions; determining salts present in natural waters; Boyle's indirect method of water analysis; Murray method of examination; Clark test for water hardness; methods of determining hardness; procedures employed for mineral examination; examination of boiler waters; form for complete analysis; useful publications dealing with mineral analysis.

Filtration, Materials. Anthracite and Sand as Filter Medium, O. J. Ripple. *Water Works Eng.*, vol. 88, no. 6, Mar. 20, 1935, pp. 277–279. Results of experimental study made at Denver, Colo., water filtration plant; equipment of filters; advantages of anthracite coal and sand; coal cheaper and does not increase in size; yearly summary of operation data.

Filtration Plants, Great Britain. Stoke Newington Primary Filters, R. Hammond. *Civ. Eng. (London)*, vol. 30, no. 344, Feb. 1935, pp. 48–52, 3 supp. plates. Design, construction, and operation of new plant for London Metropolitan Water Board, consisting of 12 filter beds, each 34 by 30 ft, divided into two halves 30 by 15 ft, by central wash water channel in walls of which are eight siphons to collect wash water and distribute raw water from and onto each of half beds; new primary filters will work up to rate of 135 gal per sq ft per hr.

Filtration Plants, Operation. Operation of Border Cities Filtration Plant. *Can. Engr.*, vol. 68, no. 22, May 28, 1935, pp. 17–1[illegible]. Extracts from report of superintendent of filtration, covering activities of filtration plant operated by Essex Border Utilities Commission.

Taste and Odor Removal. Causes and Control of Tastes and Odors in Public Water Supplies, N. J. Howard. *Can. Engr.*, vol. 68, no. 26, June 25, 1935, pp. 14–18. Outline of taste and odor causation in water supplies and modern methods employed in their prevention and removal; effect of microorganisms. Before Can. Pub. Health Assn., Toronto.

WATER WORKS ENGINEERING

Management. Reduction of Budgets During Depression. *Water Works Eng.*, vol. 88, no. 6, Mar. 20, 1935, pp. 291–292 and 295. Discussion by water works superintendents of their budgeting and retrenchment policies during depression.

Tanks, Underground. Underground Tanks for Village, M. Vrooman, Jr. *Water Works Eng.*, vol. 89, no. 1, Jan. 8, 1936, pp. 12–14. Use of automatically operated underground pressure tanks, with total capacity of 150,000 gal, by village of Plandome, L.I., to obivate unsightly elevated tank; supply secured from deep wells; well-drilling methods described; tank gallery design.

Unemployment Relief. Employment of CWA Laborers on Water Works. *Water Works Eng.*, vol. 88, no. 5, Mar. 6, 1935, pp. 239–240, and 243. Experience of water works superintendents with Civil Works Administration workers.

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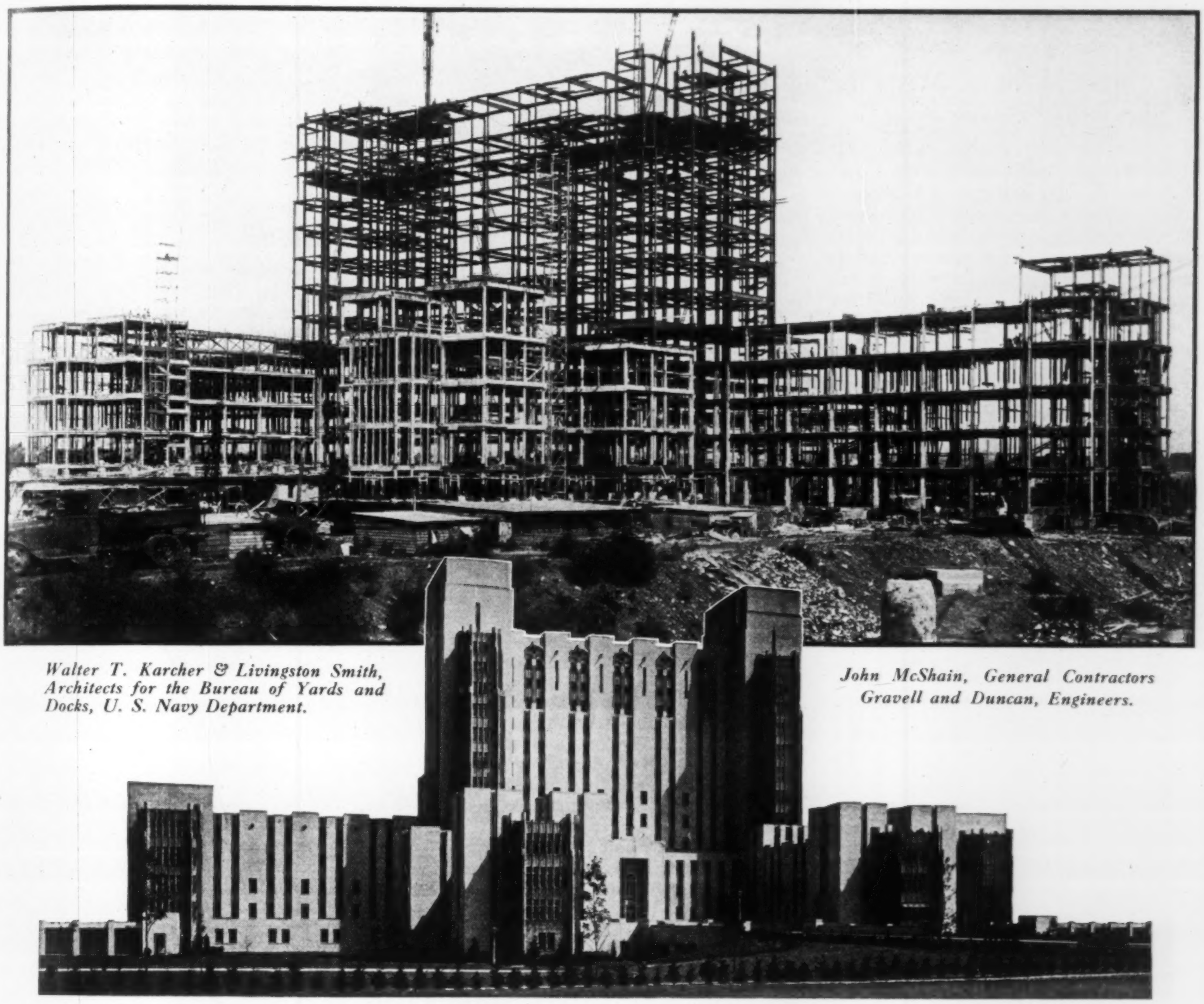

Walter T. Karcher & Livingston Smith, Architects for the Bureau of Yards and Docks, U. S. Navy Department.

John McShain, General Contractors Gravell and Duncan, Engineers.

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US STEEL

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Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

"Clinics" To Show Welding Methods for Non-Ferrous Alloys

A SERIES of welding "clinics" to demonstrate the best methods for welding various non-ferrous metals and clad materials will be held in four west coast cities during April. Included will be practical problems involving the latest methods of both electric and oxy-acetylene welding and brazing on Monel metal, aluminum, nickel, copper, brass, bronze, Inconel, and nickel-clad steel.

The "clinics" will be conducted by welding engineers of The International Nickel Company, The Aluminum Company of America, and The Revere Copper and Brass Company. They will be held as follows: April 3 and 4 at Wilkinson Company, Limited, 190 West Second Avenue, Vancouver, B.C.; April 10 and 11 at Eagle Metals Company, 21 Spokane Street, Seattle, Wash.; April 17 and 18 at Pacific Metals Company, Limited, 3100 Nineteenth Street, San Francisco, Calif.; and April 24 and 25 at Pacific Metals Company, Limited, 1400 South Alameda Street, Los Angeles, Calif.

Linde Air Announces New Booklets on Welding

Two new booklets, "How to Bronze-Weld," and "Improved Fabrication of 18-8 Chromium Steels," are announced by The Linde Air Products Company, 30 East 42d Street, New York, N.Y.

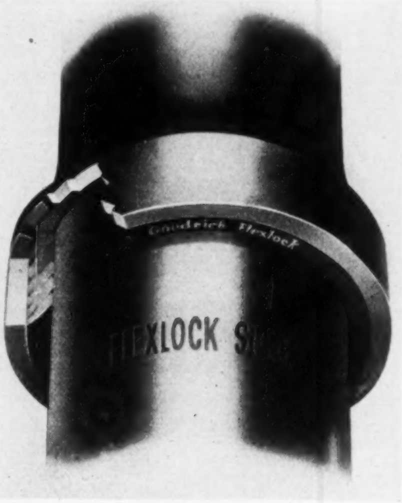
"How to Bronze-Weld," a 12-page booklet, is a practical presentation of the fundamental theory and technique of bronze welding and bronze surfacing. This booklet covers the step-by-step general procedure of bronze welding and surfacing; the bronze welding of cast iron, malleable iron, carbon steels, alloys, wrought iron, galvanized iron and steel, sheet metal, copper, brass and bronze, nickel and Monel metal; and outlines the development of the all-purpose bronze welding rod which is generally recommended.

The eight-page booklet on the "Improved Fabrication of 18-8 Chromium Steels" reviews the outstanding properties of these alloy steels and discusses the elimination of inter-granular corrosion in the base-metal zones adjacent to the weld through the use of a columbium bearing welding rod. It also outlines the actual welding procedure and the advantages of puddling the weld, heating, and fluxing, as well as other points of welding technique.

These booklets may be obtained from the manufacturer upon request.

A New Pipe Joint

THE FLEXLOCK Joint, a product of the B. F. Goodrich Company, Akron, Ohio, is now available for use with specially constructed ceramic pipe in low-pressure service—a maximum of 15 lb per sq in.—and in temperatures not exceeding 175 F.



It is reported to offer a permanent, positive seal for bell-and-spigot pipe conveying acids, alkalies, sewage, and other industrial wastes. Its adaptation to ceramic pipe was developed in cooperation with the Robinson Clay Products Co. and U. S. Stoneware Co.

The Flexlock Joint is a rubber ring or gasket having internal and external circumferential ribs which grip the bell and spigot of the pipe, as shown in the illustration. While the gasket permits easy insertion of the spigot, the shape of the corrugations combined with the resilience of the rubber, forms a multiple seal which resists any tendency of the pipe sections to pull apart. The effect of pressure is to make the joint tighter.

According to the announcement, a Flexlock Joint is water-tight, rootproof, and flexible; it does not deteriorate with age, resists corrosion, and serves to cushion and align the pipe.

Installation is simple and can be handled by ordinary workmen. In pipe sizes which can be manually handled, the joint may be made without any equipment. On larger sizes, a screw jack or yoke-type pulling device is required to propel the pipe together. Since this joint is unaffected by water, it can be applied under most unfavorable conditions.

The Flexlock Gasket is offered in two types for use with vitrified sewer pipe and chemical stoneware pipe. Both types of pipe, made to Flexlock specifications, are available in a range of sizes up to 36 in.

Cast-Iron Paving Plates for Highways

INTERLAKE Iron Co. of Chicago, Ill., is building a new plant at Toledo, Ohio, for the production of iron paving plates. This will be the first plant of its kind in the United States.

These new cast-iron paving plates, exhibited at the road show recently held in Cleveland, are reported to be virtually non-skid and wearproof. It is said that exhaustive tests have proved iron plate paving to be much more durable than other paving materials, outwearing even granite blocks. In price, the iron paving compares favorably with brick, asphalt, and other materials. Similar cast-iron paving plates have been used successfully in Europe for a number of years, according to the announcement.

The plate is constructed in the form of a $10^1/_2$-in. triangle, $1^3/_8$ in. deep. The outer edge of the plate is a flange about 1 in. deep and $^1/_2$ in. thick, with bearing points at the corners only. This three-point bearing is reported to insure stability in each plate.

Descriptive literature may be obtained from the Interlake Iron Co., 332 South Michigan Ave., Chicago, Ill.

Link-Belt Equipment on the Florida Ship Canal

MANY types of dirt excavating and haulage equipment have been placed in service on the initial excavation work being done near Ocala, Fla., for the so-called Florida Ship Canal—a 200-mile waterway which is to cross the northern mainland of the State of Florida, and connect the Atlantic Ocean with the Gulf of Mexico.

The Harvey-Ray-Noonan Construction Co., successful contractors for 2,000,000 cu yd of work, are employing a Link-belt-anti-friction belt conveying system, about 800 ft long, with pivoted stacking conveyor for discharging the dirt to the spoil pile along the sides of the future canal. The dirt moves along the conveyor system continuously, at the rate of 12,000 cu yd per day, being excavated and delivered to the system by two Link-Belt electrically operated crawler draglines working simultaneously, each equipped with a 50-ft boom and a $2^1/_2$-cu yd capacity bucket.

The conveyor system is semi-portable, being mounted on T-rail tracks, permitting it to be moved sidewise, with the aid of tractors hitched to the conveyor structure, as the excavation work progresses. Half of the canal width is excavated at first, and the other half on the return trip of the conveyor system.

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Every manufacturer and user of shovels, clam shells, draglines, cranes, and allied equipment should get the full story of the complete Fairbanks-Morse "36" line and what it can do. For full information, address Department H542, Fairbanks, Morse & Co., 900 S. Wabash Avenue, Chicago, Ill. 34 branches at your service throughout the United States.

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POWER, PUMPING AND WEIGHING EQUIPMENT

Civil Engineer; Jun. Am. Soc. C.E.; 21; B.S. C.E., New York University, 1934; 5 months rodman and transitman, New York City Department of Parks on topographical and construction surveys; 5 months with U. S. Engineers, as surveyman in New York and Pennsylvania on flood control survey. Good instrumentman; also good topographical draftsman. Desires position in civil engineering field. Location immaterial. Available immediately. D-4300.

Civil Engineer; Jun. Am. Soc. C.E.; 29; single; B.Sc. C.E., 1927; 5 years on major county and state highways (asphalt and concrete) as draftsman, estimator, office computations and design, instrumentman and inspector; 2 months structural steel detailing; 7 months estimating service station construction costs and dredging; 6 months heating and air conditioning; 14 months draftsman on aerial photo-compilation. D-4593.

Civil Engineer; Jun. Am. Soc. C.E.; 25; single; B.S. in C.E., California Institute of Technology, 1933; 3 months structural drafting; 3 months on tunnel work on Colorado River aqueduct; 3 months surveying with U. S. Geological Survey; $1^{1}/_{2}$ years on operation of equipment in chemical plant. Reserve officer. Opportunity in civil engineering desired, preferably surveying. D-4674.

Civil Engineer; Jun. Am. Soc. C.E.; 28; single, B.S. C.E., Drexel Institute, 1931; 5 years model hydraulic turbine laboratory test and cavitation research work, field test-current meter, piezometer, Gibson; 1 year timekeeping, inspection, surveying on construction. Excellent references. Desires permanent position with opportunity in any branch of civil engineering. Location immaterial. Available short notice. D-4655.

Recent Graduate; Jun. Am. Soc. C.E.; single; C.E., Rensselaer Polytechnic Institute, 1935; Sigma X; good draftsman and structural steel designer; would like position with opportunity for advancement in organization working with structural steel, especially bridges; location depends upon opportunity, but would prefer the East; 2 months experience as transitman. D-4436.

Civil Engineer; Jun. Am. Soc. C.E.; 21; single; B.S. in civil engineering, Worcester Polytechnic Institute, 1935, with advanced hydraulics option; 7 months as transitman and chief of party, highway surveying. Now temporarily employed as civil engineer in connection with graveling of country roads. Work in construction preferred. Location immaterial. Available immediately. D-4856.

Civil Engineer; Jun. Am. Soc. C.E.; 3 years as chief of party on surveys, etc. In charge of road construction project; 3 years as assistant engineer on sewer construction project; licensed engineer, state of New Jersey; $2^{1}/_{2}$ years to date with U. S. Coast and Geodetic Survey as engineer. Second-order triangulation and leveling. Observer and recorder. D-4842.

Teaching

Engineer; M. Am. Soc. C.E.; S.P.E.E.; Methodist Church; Masonic Lodge; degrees B.S., C.E., M.S.; registered professional engineer and surveyor; age 45; 7 years practical experience in various fields; 13 years successful teaching (one position), including 9 years as city engineer. Desires position teaching civil engineering or applied mechanics or position with consulting engineer. D-302.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 7 years teaching experience in hydraulic and sanitary engineering, highways, transportation economics, and surveying at accredited universities; 2 years experience in highway surveying, construction, and design; married; age 31. Desires professorship or responsible position in any one of above fields. Best references available. C-6222.

Structural Engineer; Assoc. M. Am. Soc. C.E., 35; B.S., M.S., Ph.D.; experienced in design, research, and teaching; available September 15 for teaching mechanics and structural engineering. C-3736.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1936. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

Béton Armé, Calcul Rapide et Précis des Sections. By G. Kupélian. Paris, Dunod, 1936. 125 pp., diagrs., charts, tables, 10 × 6 in., cloth, 58 frs.; paper, 48 frs.

This work is intended as a practical aid to the designer of reinforced concrete structures. The author has developed formulas for calculating the required sections which are not approximations, but precise, and which can be used as rapidly as approximate ones, by means of the diagrams and tables presented in the book. Six diagrams and eighteen tables, containing the values of about 11,000 coefficients, are included, and their use is illustrated by numerous examples that are worked out.

Bibliography of Planning, 1928–1935, a Supplement to Manual of Planning Information, 1928. (Harvard City Planning Studies, Vol. 10). By K. McNamara. Cambridge, Harvard University Press, 1936. 232 pp., 10 × 7 in., cloth, $3.50.

This bibliography covers the literature on planning which appeared between 1928 and 1935, and supplements previously published in the 1923 Manual of Information on City Planning and its 1928 supplement. There is thus provided a continued and carefully classified record of the literature, both book and periodical, for a long period. Students of planning will find it an indispensable reference tool. In addition to city planning, the bibliography covers regional, state, and national planning.

Calcul des Constructions Hyperstatiques, Application d'une Méthode très simple: Vol. 3, Cadres et Portiques Étagés Multiples. By J. Rieger and P. Carot. Paris, Dunod, 1936. Texte, 174 pp.; Planches, 78 pp., diagrs., charts, tables, 10 × 7 in., paper, 58 frs. for 2 pts.

Professor Rieger is the author of a method of computation for statically indeterminate structures for which great advantages in the way of simplicity and wide applicability are claimed. In the present volume he discusses the application of the method to multi-story structures, and illustrates its usefulness and simplicity by numerous examples.

English in Business and Engineering. By B. W. Stevenson, J. R. Spicer, E. C. Ames, and C. F. Kettering. New York, Prentice-Hall, 1936. 365 pp., diagrs., charts, maps, tables, 9 × 6 in., cloth, $2.25.

This book provides a practical course in English for college students, and also a useful reference book for the professional engineer and business man. The writing of letters and articles, public speaking, and the elements of grammar and logic are combined in a sensible, practical manner. Common faults are discussed, and correct expression is emphasized.

Highway Surveying and Planning. By T. F. Hickerson. 2 ed. New York and London, McGraw-Hill Book Co., 1936. 422 pp., diagrs., charts, tables, 7 × 4 in., leather, $3.50.

This is a rewritten and broadened edition of the author's *Highway Curves and Earthwork*, which was published in 1926. It provides a convenient manual of field and office practice on highway surveying, earthwork, curves, and transition spirals, super-elevation and curve widening, and the duties of the engineer. A collection of tables needed in highway work is included.

Der Kampf des Ingenieurs gegen Erde und Wasser im Grundbau. By A. Agatz and E. Schultze. Berlin, Julius Springer, 1936. 276 pp., illus., diagrs., charts, tables, 10 × 7 in., cloth, 26.40 rm.

The problems that confront the foundation engineer are discussed in the light of wide experience in this field. Among the topics discussed are exploratory borings, the bearing power of soils, the effects of water, pile foundations, sheet piling, and massive foundations. The book contains much of interest to the designer and builder of foundations.

Kempe's Engineer's Year Book of Formulae, Rules, Tables, Data, and Memoranda for 1936, a Compendium of the Modern Practice of Civil, Mechanical, Electrical, Marine, Gas, Aero, Mine, and Metallurgical Engineering. 42d annual issue, revised under the direction of L. St. L. Pendred. London, Morgan Brothers, 1936. 2,664 pp., illus., diagrs., charts, tables, 7 × 5 in., leather, 31s. 6d.

The 1936 edition of this well-known reference book shows no marked change from previous ones, but has undergone the customary careful revision by a large corps of competent specialists. A new section, on acoustics, has been added. The book covers a wider field than any other work of the kind, and is admirably adapted to the day-by-day needs of the practicing engineer.

Procedure Handbook of Arc Welding Design and Practice. 3 ed. Cleveland, Ohio, Lincoln Electric Co., 1935. 596 pp., illus., diagrs., charts, tables, 9 × 6 in., leather, $1.50.

This handbook, designed for convenient reference, describes the various forms of the arc welding process, supplies the essential data for welding various metals, and discusses the designing of structures and machines for arc-welded construction. This new edition has been enlarged by the inclusion of more complete information on welding procedure and new applications of arc welding.

Specification Documents for Building Materials and Construction, classified and arranged by D. H. Merrill and T. C. Combs. Los Angeles, Calif., Pacific Coast Building Officials Conference (124 West 4th St.), 1935. 522 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $5.

The 63 standard and tentative specifications and test programs, to which reference is made in the Uniform Building Code of 1935, are combined in this volume. The material is classified and arranged for ready reference. As these specifications have heretofore been available only as separate pamphlets, this collection will prove a great convenience to structural engineers, architects, and specification writers.

Statik in Bild und Gleichung. Tafeln zur allgemeinen Berechnung und Querschnittsbemessung einfacher und unbestimmter Systeme. By H. Haeger. Berlin, VDI-Verlag, 1935. Illus., diagrs., charts, tables, 12 × 8 in., paper, 48 rm.

The statics of reinforced concrete structures is presented in a concise, practical way in this work, which is intended as a guide for young designers and a handy reference work for experienced engineers. The principles of statical design and the selection of practical ones are discussed, and their application to many purposes is illustrated. The text is supplemented by a collection of tables which cover all the problems that ordinarily arise in reinforced concrete design. These are arranged for quick consultation.

The St. Lawrence Deep Waterway, a Canadian Appraisal. By C. P. Wright. Toronto and New York, Macmillan Company, 1935. 450 pp., maps and tables, 9 × 6 in., cloth, $4.50.

In this study of the project for the development of the St. Lawrence River the author considers the economic prospects primarily. What benefits will the works afford and will these benefits justify the expense, are the questions that he discusses from the Canadian point of view. The author pleads for fuller impartial consideration of the project and the treaty for its execution than has yet occurred.

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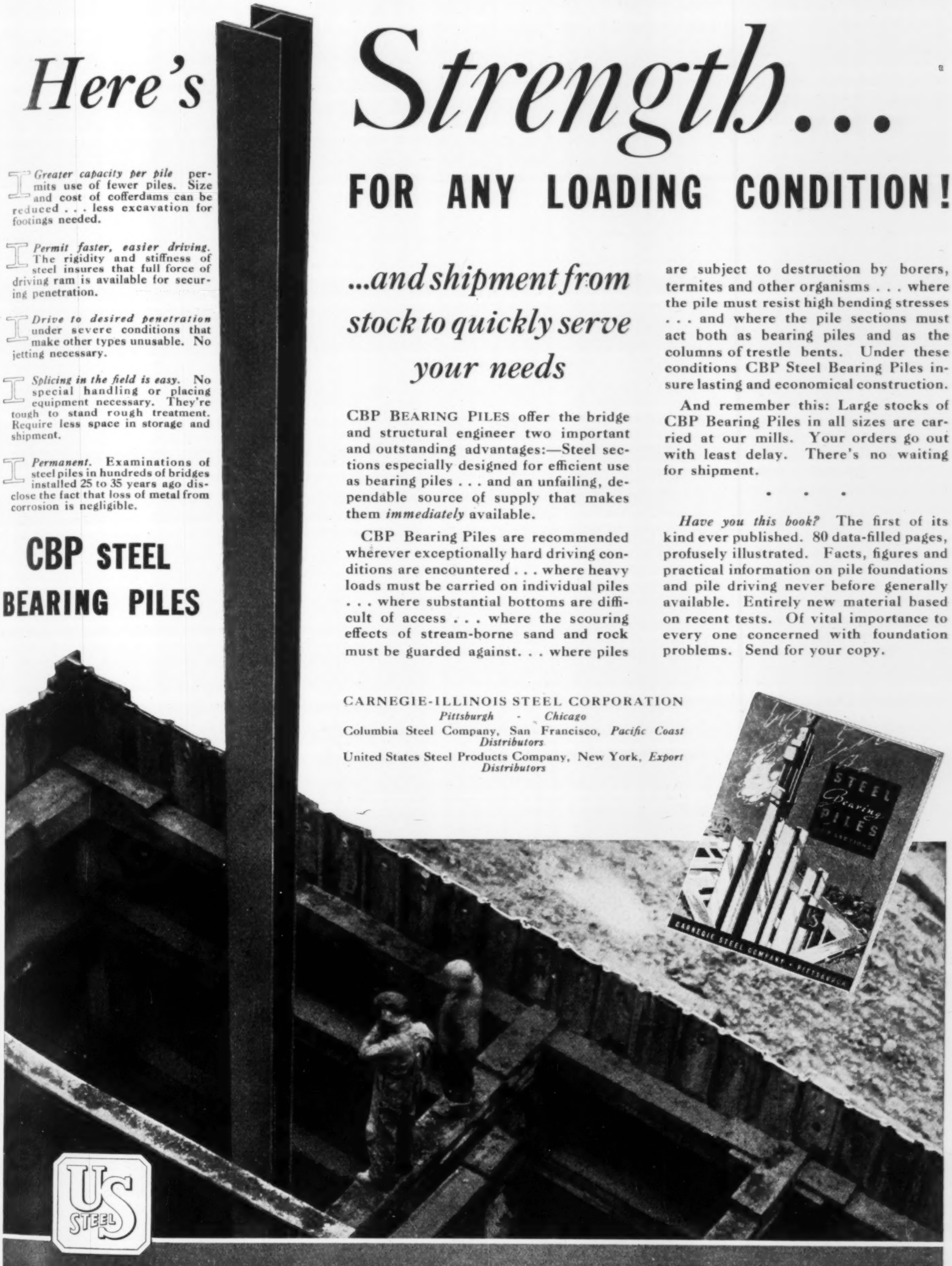

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BRIDGES

Bascule, Massachusetts. Weymouth Fore River Bridge, A. B. Greenleaf. *Roads & Streets*, vol. 68, no. 6, June 1935, pp. 191–195. History of, and traffic conditions at, Weymouth Fore River crossing between Quincy, Mass., and Weymouth, Mass.; description of new bridge consisting of draw span providing 175-ft clear width of opening with 213-ft fixed-truss span on either side; temporary piling; cable bracing; cost of project $2,134,541.

Construction, Concrete Control. Cement and Concrete Control—San Francisco-Oakland Bay Bridge, T. E. Stanton, Jr. *Am. Concrete Inst.—J.*, vol. 7, no. 1, Sept.-Oct. 1935, pp. 1–27. Cement and concrete specifications; batching; transportation; placement; design of mix; concrete designed for pumping; handling tools; vibration; light-weight concrete; temperatures of underwater mass concrete.

Construction, Greece. Some Bridge and Foundation Problems, L. Turner. *Structural Engr.*, vol. 13 (new series), no. 11, Nov. 1935, pp. 414–428. Problems encountered in construction of bridges for Salonika Plain Reclamation Works, in Greece, with special reference to testing of bridge pier foundations, research on friction piles, etc. Before Instn. Structural Engrs.

Design, Standards. Design of Bridges. I. G. Macdonald. *Machy. Market*, nos. 1833, 1834, 1835, and 1836; Dec. 20, 1935, pp. 1071–1073; Dec. 27, pp. 1091–1093; Jan. 3, 1936, pp. 7–8; and Jan. 10, pp. 29 and 28. Particular reference given to esthetic treatment; dearth of standards; meager literature; aim of esthetic design; expression of function; fitness for purpose and economy; facing reinforced concrete; characteristics of inflection. Before Pub. Works, Roads and Transport Congress.

Modern. Roads, Bridges and Tunnels in 1935. *Engineer*, vol. 161, nos. 4173 and 4174, Jan. 3, 1936, pp. 7–10, and Jan. 10, pp. 34–36, supp. plates. Examples of some outstanding modern bridges and tunnels, constructed or being constructed in different parts of the world; illustrations.

Railroad, Specifications. Design and Construction of Steel Railway Bridges and Concrete Railway Structures. *Assn. Am. Railroads—Eng. Div. Specifications*, 1935, 258 pp. Manual includes specifications for membrane waterproofing, movable railway bridges, steel railway turntables, track anchorage; specifications for plain and reinforced portland cement concrete, reinforced-concrete arches for railroad loadings, etc.

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Steel, Germany. Fuenfzehn Jahre deutscher Stahlbrueckenbau, F. Schleicher. *Bauingenieur*, vol. 16, nos. 15/16, Apr. 12, 1935, pp. 171–176. Review of 15 years of progress in steel bridge construction in Germany, including main features of most notable structures erected during that period.

Steel Truss, Buckling. Die Knicksicherheit der Druckgurte offener Fachwerksbruecken, K. Kriso. *Assn. Int. des Ponts et Charpentes—Mémoires*, vol. 3, 1935, pp. 271–294. Exact method for calculation of security against buckling of compression chord of open through-truss bridges. (In German, with brief abstracts in French and English, p. 294.)

Steel Truss, New York. Rip Van Winkle Bridge (Catskill-Hudson Bridge), A. B. Greenleaf. *Roads & Streets*, vol. 68, no. 11, Nov. 1935, pp. 350–352. Description of highway bridge, 5,040.17 ft in length, comprised of through-truss cantilever structure 1,600 ft long, 10 cantilever deck-truss spans, and two plate-girder spans; cost data.

Steel Truss, Reconstruction. Truss-Shifting Operation Feature of Bridge Revamping, G. C. Olsen. *Eng. News-Rec.*, vol. 116, no. 8, Feb. 20, 1936, pp. 232–233. Reconstruction of steel-truss highway bridge on U. S. Highway 169 crossing West Fork of Grand River in northwest Missouri; 140-ft through span cut in two lengthwise, and halves shifted simultaneously in transverse and longitudinal directions to new position on skewed piers.

Welded Steel, Design. Welded Structure Design for Dynamic Loads, O. E. Hovey. *Eng. News-Rec.*, vol. 116, no. 9, Feb. 27, 1936, pp. 310–312. Method of determining endurance-limit unit stresses, main material sections, and weld areas, with particular reference to bridge requirements; equivalent maximum stress; working unit stresses; required main material.

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Earthquake Effects. Engineering Seismology, F. M. S. Johnson. *Mines Mag.*, vol. 25, no 12, Dec. 1935, pp. 24–29 and 36. Vibrations of buildings in an earthquake; free vibration periods; effect of 1923 earthquake in Japan, and other observed data concerning behavior of buildings; flexible first-story construction for earthquake resistance; mathematical analysis and tentative conclusions. Bibliography.

CITY AND REGIONAL PLANNING

Rome, Italy. Problemi del piano regolatore di Roma. *Ingegnere*, vol. 14, no. 2, Feb. 1, 1936, pp. 83–87. Review of problems in connection with new city plan of Rome, Italy.

Seattle, Wash. Seattle Rehabilitation Planned. *Transit J.*, vol. 80, no. 2, Feb. 1936, pp. 46–49. Report to city proposing complete revamping of transit system, with elimination of antiquated cable cars and extension of bus routes; work would be carried out with federal aid and retirement of present loan.

Slums. Slum Clearance, R. H. Matthew and R. F. Reekie. *Roy. Inst. British Architects, J.*, vol. 43, 3d series, no. 8, Feb. 22, 1936, pp. 393–415. Outline of two prize-winning schemes submitted for Bossom Travelling Studentship, 1935–1936, detailing types of houses and educational, health, and amusement facilities; details of construction proposed.

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CONCRETE

Aggregates, Slag. Review of Construction and Materials. Foamed Slag: New Structural Material. *Roy. Inst. British Architects—J.*, vol 43, 3d series, no. 7, Feb. 8, 1936, pp. 376–379. Abstracts of series of reports made by Building Research Station on foamed slag, usable as concrete aggregate either for in situ work, in pre-cast block form, or in loose form for insulating purposes; concrete of foamed slag; stability of slag and foamed slag; foamed slag in mortar.

Aggregates, Treatment. Removing Fines from Sand with Air Blowers, J. Stearns. *Eng. News-Rec.*, vol. 116, no. 10, Mar. 5, 1936, pp. 344–346. Method of treating concrete aggregates used in Colorado River Aqueduct to relieve them of excess of fines; twin fans suck dust from separation unit and discharge through 22-in. horizontal pipe; arrangement of mechanism at East Iron Mountain for dry cleaning dust from sand to be used in concrete.

Cement, Pozzuolan. Properties of Mortars and Concretes Containing Portland-Puzzuolan Cements, R. E. Davis, J. W. Kelly, G. E. Troxell, and H. E. Davis. *Am. Concrete Inst.—J.*, vol. 7, no. 1, Sept. Oct. 1935, pp. 80–114. Results of cooperative investigation of portland-pozzuolan cements to determine effect of chemical composition, physical character, and proportion of pozzuolan upon strength, volume change, resistance to action of sodium sulfate and other properties of mortars and concretes. Bibliography. Before Am. Concrete Inst.

Construction, Code. A.C.I. Convention Adopts New Building Code. *Eng. News-Rec.*, vol. 116, no. 10, Mar. 5, 1936, pp. 356–359. Proceedings of 1936 annual convention of American Concrete Institute, including abstracts of papers and discussions on new building code; longer life for concrete; concrete repair; economics of high strength; new workability studies; concrete in construction; weatherproof walls; modern cast stone.

Construction, Vibrating. Placing Concrete by Means of Vibration. *Am. Concrete Inst.—J.*, vol. 7, no. 1, Sept.-Oct. 1935, pp. 65–79. Symposium including three papers: Concrete Vibrating Practices in France, B. Moreell; Practical Applications of Vibration for Placing Concrete, S. Comess; Observations on Use of Vibration in Field, T. C. Powers.

Curing. Dampfhaertung von Stampfbeton, A. W. Woljenski. *Zement*, vol. 24, no. 36, Sept. 5, 1935, pp. 570–573. Steam curing of tamped concrete; experiences in Moscow in 1934 in production of tamped concrete blocks according to steam curing process in chambers under steam pressure.

Design. Some Points in Design of Reinforced Concrete Works, G. Berry. *Instn. Mun. & County Engrs.—J.*, vol. 17, no. 17, Feb. 18, 1936, pp. 892–905, (discussion) 906–916. Safe working stresses; questions of reinforcement; cover to rods; quantities; questions of shear; footings; slabs; columns; beams and slabs; design of tanks; reduction of stress.

Mixing. Cement-Water Ratio a Simpler Method, G. R. Wernisch. *Concrete*, vol. 43, no. 12, Dec. 1935, pp. 7–8. Simplification of concrete design on job through more general application of newer method urged by author.

Plasticity. Mechanics of Plastic Flow of Concrete, J. R. Shank. *Am. Concrete Inst.—J.*, vol. 7, no. 2, Nov.-Dec. 1935, pp. 149–180. Critical review of data; reduction of data to cover equations; classification and analysis of data; effect of age at loading; effect of curing conditions; effect of unit stress; high-early-strength cements; aluminous cements. Bibliography.

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Reinforcement. Isteg Steel for Concrete Reinforcement, D. B. Steinman. *Am. Concrete Inst.—J.*, vol. 7, no 2, Nov.-Dec. 1935, pp. 183–194. Discussion of Columbia University tests of patented European steel reinforcement consisting of two plain round bars, initially straight and parallel, which have been twisted together cold to form double helix; tension, cold bend, and rectangular beam tests; tests on I-beams: condition of beams at failure; bond tests; intermediate-grade steel.

Shrinkage. Shrinkage of Concrete, I. Lyse. *Am. Soc. Testing Matls.—Proc.* vol. 35, pt. 11, 1935, pp. 383–398. Results of investigation of use of ordinary 3 by 6-in. concrete cylinders for volume-change observations and of observing these changes by use of Ames dial attached to metal base; study of factors that contribute to volume change in concrete, including quality and quantity of cement paste used, length of moist curing, and different cements and aggregates.

Water Works Construction. Reinforced Concrete Structures for Retention of Water and Other Fluids—I, W. H. Rose. *Structural Engr.*, vol. 13 (new series), no. 10, Oct. 1935, pp. 382–403. Theory of design of concrete reservoirs and elevated water tanks; structural details. Before Instns. Structural, Civil and Municipal and County Engrs.

DAMS

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Concrete Gravity, Tennessee. Handling of Cement and Concrete at Wheeler Dam, Tennessee River. *Engineering*, vol. 141, no. 3651, Jan. 3, 1936, pp. 6–8, supp. plates. Illustrated description of equipment and methods used.

Earth, Construction. Modified Soil Control Proposed for Rolled-Fill Dam Construction, F. B. Campbell. *Eng. News-Rec.*, vol. 116, no. 5, Jan. 30, 1936, pp. 158–159. Experience with Proctor method of soil control on Sutherland reservoir, near North Platte, Nebr., indicating desirable changes to speed work without loss of efficiency; soil compaction; compaction curves for very fine sandy material, showing that beyond 20 blows of tamping rod there is little change in density.

Multiple Arch. Multiple Arch Dams, G. B. Williams. *Indian Eng.*, vol. 99, no. 1, Jan. 1936, pp. 17–26. Prejudices against multiple-arch dams; stresses in arch fixed at ends; Cain's formulas; F. H. Fowler's diagrams; graphic comparison of Cain's formulas with cylinder formula; F. A. Noetzli's formula; working stress intensities; design of buttress; failures; comparative cost of multiple-arch dams and other types; examples.

Spillways, Model Testing. Spillway Gate Model Supplements Calculations, R. R. Clark. *Eng. News-Rec.*, vol. 116, no. 10, Mar. 5, 1936, p. 343. Experimental study of handling of 525-ton lift gates of Bonneville Dam carried out on one-tenth scale model equipped with complete operating mechanism.

United States. Large Dams in United States. *Reclamation Era*, vol. 26, no 2, Feb. 1936, pp. 50–51. Tabulated statistical and descriptive data on largest dams of United States.

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Runoff, United States. Studies of Relations of Rainfall and Runoff in United States, W. G. Hoyt and others. *U. S. Geol. Survey Water-Supply Paper*, no. 772, 1936, 301 pp. Price 25 cents. Presentation of data and their analysis; changes in precipitation, temperature, and runoff, by basins; stream flow; surface runoff, by basins; stream flow; surface runoff; unit-hydrograph method and storm transposition in flood problems relating to great storms in eastern and central United States, M. Bernard; ground-water runoff; runoff during drought; comparison of deficiencies in ground-water runoff with deficiencies in rainfall. Bibliography.

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Bridge Piers. Bridge Foundations. Use of Modern Piling. *Roads & Road Construction*, vol. 13, no. 152, Aug. 1, 1935, pp. 250–251; see also *Roads & Streets*, vol. 68, no. 10, Oct 1935, pp. 323–324. Use of various types of sheet piling and so-called box piles in construction of piers for American and European bridges.

Caissons, Steel, Rotating. Sinking Eight-Foot Rotary Caissons in New York. *Engineer*, vol. 160, no. 1170, Dec. 13, 1935, pp. 615–617. Sinking of caisson in connection with erection of federal office building; type of caisson employed is immense core drill with saw-toothed cutting edge arranged to be rotated at varying speeds while working its way down through different strata of ground.

Piles, Driving. Les pieux battus dans l'eau. L. F. Goemans. *Technique des Travaux*, vol. 12, no. 2, Feb. 1936, pp. 89–99. Review of modern methods of driving wooden and concrete pipes into subaqueous foundations; examples from recent European practice.

Settlement. Zur Vorausbestimmung von Bauwerkssetzungen, K. Fischer. *Beton u. Eisen*, vol. 34, no. 10, May 20, 1935, pp. 157–161. Theoretical discussion of methods of predicting amount of settlement in foundations; relative settlement of equivalent areas differing in shape; observations of settlement of chimney foundations and houses. Bibliography.

Soils, Physics. Characteristics of Cohesionless Soils Affecting Stability of Slopes and Earth Fills, A. Casagrande. *Boston Soc. Civ. Engrs.—J.*, vol. 23, no. 1, Jan. 1936, pp. 13–32. Meaning of stability; shearing resistance of cohesionless soils; volume change during deformation affecting stability; comparison of effects of vibrations and deformations; effect of disturbances on stability of cohesionless soils; earth movements caused by hydrodynamic stresses due to reduction of volume; methods for compacting cohesionless soils.

Subsidence. Betrachtungen zur Baugrundchaedenfrage, G. Keller. Glueckauf, vol. 71, no. 34, Aug. 24, 1935, pp. 812–814. Problems of foundation subsidence damages; observations made in Ruhr district due to tectonic and stratigraphic conditions discussed and examples given, in order to establish extent to which it is due to natural conditions.

Wood Preservation, Railroads. Report of Committee XVII—Wood Preservation. *Am. Ry. Eng. Assn.—Bul.*, vol. 37, no. 383, Jan. 1936, pp. 509–533, 1 supp. plate. Service-test records for treated ties; piling used for marine construction; destruction by termites and possible ways of prevention; effect of preservative in treated ties in track due to blowing off locomotives on line of road.

HYDROLOGY, METEOROLOGY, AND SEISMOGRAPHY

Lakes, Regulation. Valutazione delle disponibilità idriche conseguenti alla regolazione di un lago naturale (Lago di Como), G. Marcello. *Energia Elettrica*, vol. 12, no. 4, Apr. 1935, pp. 299–306. Estimate of additional hydraulic sources that became available through regulation of Lake Como in northern Italy; effect on flood hydrographs, irrigation, and power.

Meteorology, United States. Weather and Water in 1935. *Eng. News-Rec.*, vol. 116, no. 6, Feb. 6, 1936, pp. 223–224. Review of meteorological conditions in United States in 1935 consisting of following two articles. Weather, M. W. Hayes; Water, J. C. Hoyt.

Rain and Rainfall, Periodicity. Application of Rainfall Cycles tc Problems of Water Supply, H. P. Gillette. *Roads & Streets*, vol. 68, no. 11, Nov. 1935, pp. 360–364. Discussion of further studies of periodicity of rainfall.

INLAND WATERWAYS

Canals, Construction. Subgrader and Concrete Finisher of New Design for Large Canal. *Eng. News-Rec.*, vol. 116, no. 8, Feb. 20, 1936, pp. 279–282. Description of two novel machines, developed for work on open canal portions of Colorado River aqueduct, trimming subgrade exactly and placing concrete lining without joints; unit costs.

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Elasticity, Research. Recent Research in Elasticity, J. N. Goodier. *Am. Soc. Mech. Engrs.—Trans. (J. Applied Mechanics)*, vol. 3, no. 1, Mar. 1936, pp. A-26–27. Brief review of some recent publications on theory of elasticity, stress analysis, stability, and photo-elasticity. Bibliography.

Floors, Concrete Joist. Load Performance Tests of Pre-cast Joist—Pre-cast Slab Floor Construction, R. E. Copeland. *Am. Concrete Inst.—J.*, vol. 7, no. 2, Nov.-Dec. 1935, pp. 195–211. Tests of light-weight concrete floor of pre-cast reinforced-concrete slab sections laid on and united to pre-cast reinforced-concrete joists, used in houses erected for Tennessee Valley Authority; effects of bond-joint design type of mortar, type of aggregate, length of span and type of loading.

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PORTS AND MARITIME STRUCTURES

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Bordeaux, France. Improvements in Maritime Estuary Leading to Port of Bordeaux, F. Leveque. *Civ. Eng. (London)*, vol. 30, nos. 344 and 345, Feb. 1935, pp. 58–60, and Mar., pp. 85–93. February: Description of Gironde estuary and its surroundings; creation of new outlet in submarine bar; shoals; outside bar. March: Height of tides; main passage for overseas navigation; solids in tidal flow; crossing of bar; dredging; lessons of experience; signaling system; costs. Before Société des Ingénieurs Civils de France.

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Breakwaters, Design. Sur un mouvement approché de clapotis, Gourret. *Annales des Ponts et Chaussees*, vol. 1, no. 3, Mar. 1935, pp. 337–451. Development of mathematical theory of wave action and its application to design of vertical-face breakwaters and seawalls; analysis of designs applied in actual practice.

Seawalls, Australia. Notes on Development of Quay Walls, F. Andres. *Instn. Engrs. Australia—J.*, vol. 7, no. 3, Mar. 1935, pp. 93–97. Review of Australian practice in design and construction of seawalls with special reference to design adopted at Port Adelaide, S.A.

Shore Protection, United States. American Beach and Shore Protection Works, E. E. R. Tratman. *Engineer*, vol. 161, nos. 4175, 4176, 4177, 4178, 4179, and 4180; Jan. 17, 1936, pp. 64–66; Jan. 24, pp. 92–94; Jan. 31, pp. 116–118; Feb 7, pp. 142–143; Feb. 14, pp. 168–170; and Feb. 21, pp. 194–196. Account of developments and research; illustrated description of outstanding beaches in United States; beach groins and permeable groins; beach and cliff protection; railway protection works; seawall construction; lake beaches.

Wave Effect. Experimental Studies of Effect of Waves on Maritime Structures, V. E. Timonov. *Zentralniy Nauchno Issledovatelsky Institut Vodnovo Transporta—Sbornik Nauchno Issledovatelskikh Materialov*, 1934, pp. 74–103. Analysis of Italian, German, Chilean, British, French, and Spanish investigations of dynamic action of waves on maritime works, performed in accordance with decision of International Navigation Congresses and with conclusions of International Committee for investigation of wave action. (In Russian, with brief English abstract, p. 103.)

ROADS AND STREETS

Belt. 3½-Mile Express Highway in St. Louis, Mo. *Roads & Streets*, vol. 68, no. 11, Nov. 1935, pp. 347–349. Construction of express highway belt about St. Louis; securing right of way through city.

Concrete. Sawdust on Fresh Concrete for Curing Pavement in Oregon. *Eng. News-Rec.* vol. 116, no. 9, Feb. 27, 1936, p. 317. Use of sawdust as substitute for earth to retain moisture over freshly laid concrete paving; sawdust curing costs on 19,684 sq yd of concrete.

Concrete, Paving. Concrete Paving Practice for Oregon State Highways, N. M. Finkbiner. *Roads & Streets*, vol. 68, no. 12, Dec. 1935, pp. 383–388. Review of Oregon State Highway Commission's practice as to design, mix, spreading and compacting, belting, floating, edging and brooming, preliminary curing, checking and planing, and final curing.

BETHLEHEM *Steel* H-PILING

In this pier at Puerto-Armuelles, steel H-piling fulfills the requirements of earthquake-resistant design

in construction of tropical pier

This new pier of the United Fruit Company at Puerto-Armuelles, Republic of Panama, replacing one of a different construction which was destroyed by earthquake, is built on a foundation of Bethlehem Steel H-Piling.

The piles used were 14-in., 87- to 167-lb. sections, some of which were reinforced with welded-on steel channels. All were coated with gunite, to prevent the adherence of tropical shellfish and marine growths, and provided with timber lagging, to develop greater bearing. In water up to 54 feet in depth and with an average penetration of 40 feet, in relatively unstable footing, consisting chiefly of soft, silty sand and clay, this piling carried safely loads of nearly 80 tons per pile.

Steel H-piling meets ideally the requirements of earthquake-resistant design, because of its high lateral strength, flexibility and adaptability to use with strong steel bracing. Successful application in this harbor project is further evidence of the wide range of usefulness of this type of piling. For piers in many harbors, as well as for buildings, bridges, trestles and other structures, the use of Bethlehem Steel H-Piling may provide the sound, economical solution to foundation problems.

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CURVES. Setting Out Transition Curves in Difficult Situations, F. G. Royal-Dawson. *Road. & Road Constructian*, vol. 13, no. 152, Aug. 1, 1935, pp. 243–247. Numerical examples of design of transitions in which entire curve is not visible from springing point; circular continuation of curve; comparsion of lemniscate and spiral; methods of setting out.

DESIGN. Effect of Pavement Widths Upon Accidents, R. L. Morrison. *Roads & Streets*, vol. 68, no. 7, July 1935, pp. 242–245. Results of study by University of Michigan; nature of truck accidents; economic aspects; additional cost of accidents on 18-ft pavement appears to be greater than annual cost of additional 2 ft of pavement. Before Highway Research Board.

HIGHWAY SYSTEMS, CALIFORNIA. Road Construction in Death Valley, C. F. Greeves-Carpenter. *Highway Mag.*, vol. 27, Feb. 1936, pp. 28–31. Description of highway system of Death Valley, with special reference to methods of construction used.

HIGHWAY SYSTEMS, GERMANY. Le VIIe Congrès International de la Route. Pt 2: La voirie allemande, Amédée-Mannheim. *Annales des Ponts et Chaussées*, vol. 105, no. 3, Mar. 1935, pp. 453–490. Description of highway system of Germany—its organization, present status, operation, and maintenance; types of pavements and pavement materials.

MAINTENANCE AND REPAIR. Winter Problems on Alaskan Roads, H. Sterling. *Roads & Streets*, vol. 68, no. 12, Dec. 1935, pp. 399–400. Ice damage and obstructions; snow slides; how ice is handled; compensations.

ROADSIDE IMPROVEMENT. Progress in Roadside Development. *Roads & Streets*, vol. 78, no. 4, Apr. 1935, pp. 145 and 147. Cost of actual planting and seeding operations; landscape organization; basic landscape principles; highway as part of landscape; appearance of roadside structures; landscape plantings; work-relief value.

SNOW REMOVAL. Fighting 23-Inch Snowfall, E. M. Hunt. *Am. City*, vol. 51, nos. 1 and 2, January 1936, pp. 57–58, and February, pp. 73, 75, and 77. Organization, personnel, and equipment for snow removal in Portland, Me.; care of icy sidewalks; plowing sidewalks; snow-handling equipment; work continuous during storm; loading and hauling snow; dump organization; costs.

SOIL STABILIZATION. Practical Soil Stabilization, C. A. Hogentogler. *Roads & Streets*, vol. 78, no. 3, Mar. 1935, pp. 92–98. Theory of stability; combined internal friction and cohesion control; shear strength; matter in film phase; adsorbed films have high densities; wetting power; adhesive films capable of furnishing enormous cohesion; essential features of well-graded materials; compaction tests; surface treatments required on densified soils; low-cost all-weather roads in highway program. Before Assn. Highway Officials of North Atlantic States.

SUBSOILS. Soils. *Am. Soc. Testing Matls.—Proc.*, vol. 35, pt. 1, 1935, pp. 940–982. Tentative methods of surveying and sampling soils for use in place as subgrades for highways; preparing soil samples as received from field for mechanical analysis and determination of subgrade soil constants; mechanical analysis of soils; liquid limit of soils; plastic limit and plasticity index; centrifuge and field moisture equivalent of soils; shrinkage factors.

SEWERAGE AND SEWAGE DISPOSAL

CLOROBEN. Use of "Cloroben" in Sewage Treatment, W. Rudolfs and L. R. Setter. *Sewage Works J.*, vol. 8, no. 1, Jan. 1936, pp. 38–56. Laboratory experiments to determine possible uses of "Cloroben" which consists principally of ortho-dichlorbenzene; effect of Cloroben on bacteria, on settling and compacting of solids, on dewatering of fresh solids, and on coagulation of sewage; effect of distribution of Cloroben; effect of activated sludge; comparison of effect of Cloroben and chlorine on odors.

GAS RECOVERY, ENGINES. Engines Run On Sludge Gas. *Power*, vol. 80, no. 3, Mar. 1936, pp. 120–122. Sewage and sludge can be made, paradoxically, to help dispose of themselves, if process gas generated during disposal is utilized; number of municipalities facing sludge-disposal problem have used gas engines successfully; three recent plants in California described.

GAS RECOVERY, PALO ALTO, CALIF. Palo Alto Sewage Treatment Plant, H. O. Banks. *Sewage Works J.*, vol. 8, no. 1, Jan. 1936, pp. 68–84. Description and results of operation of plant serving population of 21,000: disposal of digested sludge; gas production and collection; gas utilization; generation of electricity at Palo Alto with gas engine. Before Calif. Sewage Works Assn.

IRRIGATION. Verwertung haeuslicher und gewerblicher Abwaesser durch Verrieselung, Kreuz. *Gesundheits-Ingenieur*, vol. 58, no. 14, Apr. 6, 1935, pp. 190–191. Utilization of domestic and industrial sewage for irrigation. Abstract of paper before joint meeting of Deutsche Gesellschaft fuer Bauwesen and Verein deutscher Chemiker.

SEWERS, EXPLOSIONS. Der Kampf gegen den Einlauf feuergefaehrlicher oder zerknallfaehige Gase entwickelnder Fluessigkeiten in das Entwaesserungsnetz der Stadt Berlin, Nichterlein and Notz. *Gesundheits-Ingenieur*, vol. 58, no. 13, Mar. 30, 1935, pp. 179–181. Control measures practiced in sewerage system of Berlin, Germany, for prevention of inflow of inflammable liquids and of fluids which may produce explosive gases.

SEWERS, GREASE TRAP. Hormung der Fettabscheider. *Gesundheits-Ingenieur*, vol. 58, no. 12, Mar. 23, 1935, pp. 164–166. German specifications for design, installation, and testing of grease traps.

SLUDGE. Sedimentatfon and Anaerobic Digestion of Sewage-Sludge at Colac, Echuca, and Mildura, Australia, E. T. M. Garlick. *Instn. Civ. Engrs.—J.*, no. 4, Feb. 1936, pp. 50–82, 2 supp. sheets. Methods and results of sedimentation and digestion of sewage sludge with surplus activated sludge at Colac, Echuca, and Mildura, Australia; gas production; sludge drying; total population served by these three plants is about 32,000.

STRUCTURAL ENGINEERING

BEAMS, ALUMINUM. Aluminum Stringer Failures Due to Fatigue Loading, H. D. Johnson, Jr. *Eng. News-Rec.*, vol. 116, no. 9, Feb. 27, 1936, pp. 318–320. Poorly placed tiles on Smithfield Street Bridge in Pittsburgh concentrated loads on edge of outstanding legs of flanges, subjecting them to repeated stresses above yield point; locations of fractures; microscopic examination; stresses and mechanical properties; local deflections and stresses of flanges of stringers.

EARTH PRESSURE. Die Verteilung des Erddrucks bei gleichfoermiger Auflast nach der Theorie von Coulomb, O. Mund. *Bautechnik*, vol. 13, nc. 20, May 10, 1935, pp 253–255. Theoretical graphical analysis of distribution of earth pressure due to uniform loading according to Coulomb's theory.

FRAMES, STRESS ANALYSIS. Stress Behavior in Steel Rigid Frames Sought in Research Program. *Eng. News-Rec*, vol. 116, no 9, Feb. 27, 1936, p. 313. Testing of large-size steel rigid frames under way at U. S. Bureau of Standards to determine stress distribution in and around knee sections.

RESEARCH. Current Studies at Lehigh University, I. Lyse. *Eng. News-Rec.*, vol. 116, no. 11, Mar. 12, 1936, pp. 391–392. Results of recent experimental studies on design of steel-plate floors, welded clip angles, shear and bending in welds, concrete shrinkage; concrete-slab studies.

SIPHONS, CONCRETE. Design of Reinforcement in Circular Concrete Siphons, D. B. Gumensky. *Eng. News-Rec.*, vol. 116, no. 11, Mar. 12, 1936, pp. 380–382. Considerations and controlling factors in stress analysis to ensure proper arrangement of steel reinforcing; loads on pipe; combined tension and bending; reinforcement in aqueduct siphons; unit stress in steel; longitudinal reinforcement.

TRUSSES, DESIGN. Continuous Truss Design by Moment Distribution, T. P. Young. *Eng. News-Rec.*, vol. 116, no. 11, Mar. 12, 1936, pp. 382–383. Use of column analogy to determine stiffness and carry-over factors of truss spans permitting inclusion of effects of web deformations.

TUNNELS

RAILROAD, LINING. Large-Scale Operations Speed Tunnel Relining Project. *Ry. Eng. & Maintenance*, vol. 32, no. 2, Feb. 1936, pp. 74–78 and 81. In order to dry up and repair lining of 7,500-ft brick-lined tunnel at Baltimore, to eliminate formation of icicles during winter and to permit electric train operation, 9-car, self-contained gunite train was used to carry out work, without interfering with traffic; problems encountered in maintaining equipment to full efficiency under existing conditions.

WATER SUPPLY. Determinazioni sperimentali dei coefficienti di scabrezza di grandi gallerie e condotte forzate in cemento armato. *Energia Elettrica*, vol. 12, no. 4, Apr. 1935, pp. 243–248. Experimental determination of friction coefficient and losses of head in three Italian water supply tunnels and pressure conduits, 2.5 m to 3.0 m in diameter, 1,443 m to 4,190 m in length; friction coefficients expressed in terms of Bazin and Gauckler-Strickler formulas.

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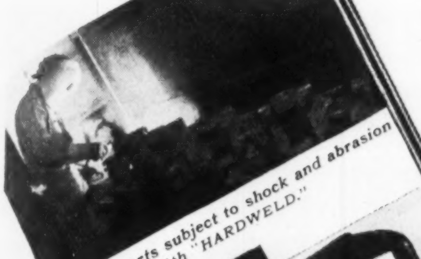

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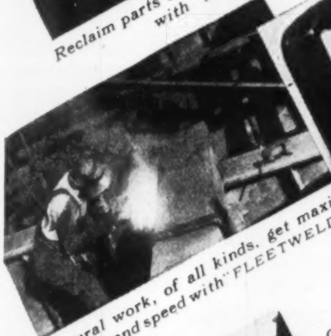

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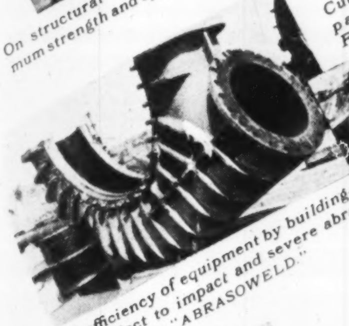

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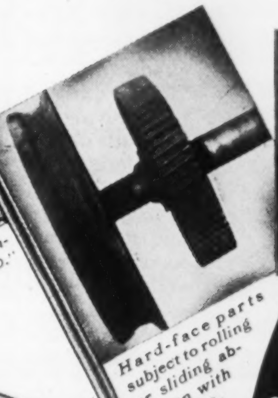

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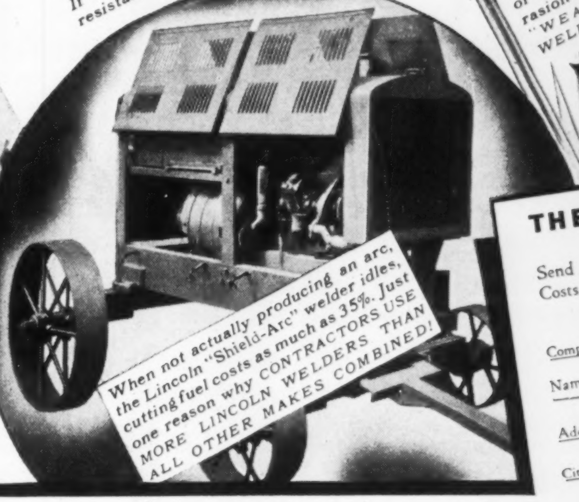

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Equipment, Materials, and Methods

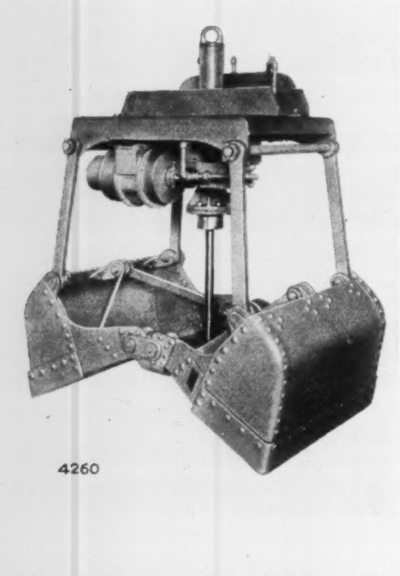
New Developments of Interests, as Reported by Manufacturers

Cast-Iron Joints

THE UNITED States Pipe & Foundry Company of Burlington, N.J., announces the U. S. joint for use in gas, water, and steam service. The pipe joint may be assembled with a wrench, and is said to need no caulking or compounds for securing joints. Accessories consist of follower ring, gaskets, and bolts, all of which are interchangeable. Some of the advantages reported for this type of joint are deflection without leakage, ease of assembly, tightness under pressure of gas or water, resistance to corrosion, and connection to plain and existing pipe line without use of an adapter. Asbestos may be supplied if desired for high-temperature service.

Hayward Announces Electro-Hydraulic Bucket

ACCORDING to a recent announcement, The Hayward Company, 50 Church Street, New York, N.Y., has just brought out the Hayward Electro-Hydraulic Bucket. This is a new and improved type of clam-shell bucket, and as its name implies, is operated by means of a motor-driven fluid pump controlling a hydraulic ram.



Like the Hayward Electric Motor Clam Shells, this new bucket can be hooked on to a crane, electric hoist, or ordinary derrick. Opening and closing are accomplished by the electric motor, controlled from the operator's cab. No closing line or winding drum is required.

Further information and literature can be obtained by writing direct to the manufacturer.

New Bristol Thermometer Catalog

THE BRISTOL Company, Waterbury, Conn., announces the publication of a new thermometer catalog, containing 88 pages of information concerning the theory and practice of present-day thermometry. This catalog, No. 1250, covers liquid-filled, vapor-tension, and gas-filled recording, indicating, and controlling thermometers. It also describes a new small-bulb gas-filled thermometer. In connection with automatic temperature controllers, it gives information regarding both the electric and pneumatic types, and helpful sketches to illustrate how they are applied. Application data are given on industrial stem thermometers, resistance thermometers, humidity measuring instruments, control valves, time-temperature controllers, and the accessories that are used with thermometers on industrial applications. Over 500 temperature recording charts, the most complete listing ever published, are illustrated in full size.

Oxwelding Brass and Bronze

AN ILLUSTRATED 12-page booklet on the oxy-acetylene welding of brass and bronze has been published by The Linde Air Products Company, 30 East 42d Street, New York, N.Y.

There are two main sections to the booklet. The first is devoted to the technique of fusion welding brass and bronze. Methods of determining the type of flame and welding procedure in general and special cases are given. The second section covers the welding of commercial yellow brass pipe. Joint design and welding technique are discussed in detail. Three tables give data on welding time, material consumption, and tensile strength of welds made in various positions.

Allis-Chalmers Catalogs

THE ALLIS-Chalmers Manufacturing Company of Milwaukee, Wis., has published two new catalogs.

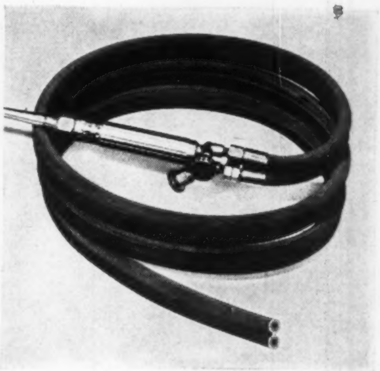
"Construction" is a 40-page booklet, $5\frac{1}{2}$ in. by $8\frac{1}{2}$ in., containing information on the entire line of Allis-Chalmers road machinery.

The model "K" catalog of 24-pages, $8\frac{1}{2}$ in. by 11 in., gives complete information on the "K" and "WK" gasoline tractors.

Copies of these catalogs will be forwarded by the manufacturer.

A New Duplex Hose

A NEW type of rubber tubing especially designed for welding equipment and similar services, has just been placed on the market. Twin hose are simultaneously molded with a connecting web between them, so that a cross-section resembles the figure 8. A single length of this twin non-kinking hose is all that is necessary for equipment which heretofore has required two lengths of separate hose. The connecting web of the twin hose may be cut down with a carborundum wheel for attaching hose to separate outlets. It is reported also that this hose is constructed with a special cord-wound reinforcement between the first and second braid, giving it a much higher burst limit than ordinary welding tubing. The bursting limit for the $\frac{1}{4}$-in. size is said to be 2,000 lb. Differing pressures in each size can be used without torque or writhing.



Supero Siameez is the trade name adopted for this hose by the manufacturers, Electric Hose & Rubber Co., Wilmington, Delaware. Supero Siameez hose is made with individual hose in different colors—red and black or red and green—or with both hose lines the same color.

New Drafting Machine

THE WRIGRAPH Model E-272, a newly designed drafting machine mounted on a 22-in. by 30-in. cleated white-pine board, is announced by L. G. Wright, Inc., 5713–52 Euclid Ave., Cleveland, Ohio.

The Model E-272 is equipped with a hand-assembled parallel mechanism, calibrated for accuracy and completely guaranteed; with a vernier indicating protractor reading to degrees; and with a graduated L-square blade made of pyroxylin riveted to an aluminum stiffener. The machine is also available without the board.

Section of 105-year-old cast iron water main still in service in St. Louis

ST. LOUIS' *water distribution system is* 98.7% CAST IRON PIPE

From the "father of waters," the Mississippi River, and the Missouri as well, the City of St. Louis derives its water supply. Through two filter plants with a combined capacity of 240-million gallons daily the muddy flow of these mighty rivers is converted into clear, wholesome and moderately soft water. The filter beds occupy 403 acres. Average total daily consumption (1934), 117.2 million gallons daily. The distribution system contains more than 1200 miles of pipe of which 98.7 per cent is cast iron pipe.

The average percentage of cast iron pipe in the water distribution systems of the 15 largest cities in the United States is 95.6%. Cast iron pipe is the standard material for water mains. It costs less per service year and least to maintain. Its useful life is *more than a century* because of its effective resistance to rust. It is the one ferrous metal pipe for water and gas mains, and for sewer construction, that will not disintegrate from rust. It is available in diameters from 1¼ inches to 84 inches.

For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1013 Peoples Gas Building, Chicago, Illinois.

The following tabulation shows the percentage of cast iron pipe used in the water distribution systems of the 15 largest cities in the United States as reported in 1935 by their Water Departments.

CITY	PERCENTAGE
New York	97.2
Chicago	100.0
Philadelphia	98.3
Detroit	98.7
Los Angeles	74.0
Cleveland	98.9
St. Louis	98.7
Baltimore	99.7
Boston	99.8
Pittsburgh	97.9
San Francisco	76.8
Milwaukee	100.0
Buffalo	99.8
Washington D.C.	98.8
Minneapolis	95.8

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BRIDGES

Concrete, Pre-Cast. Pre-Cast Reinforced Concrete Highway Bridge. *Ry. Gaz.*, vol. 64, no. 12, Mar. 20, 1936, pp. 568–569. Bridge reconstruction with use of pre-cast reinforced concrete girder and trestle-bent units, completed by Great Western Railway near Kerry in Montgomeryshire; new 3-span structure, over 100 ft long, carries 15-ft road over single-line branch from Abermule, and replaces old timber pile bridge.

Design. Some Recent Bridges, H. C. Bradshaw. *Roy. Inst. Brit. Architects—J.*, vol. 43, 3d series, no. 10, Mar. 21, 1936, pp. 509–520 and (discussion) 521–523. Architectural features of recent steel and reinforced-concrete bridges of all types.

Flood Protection. Bridge Railings Removable in Case of Floods, J. W. Beretta. *Eng. News-Rec.*, vol. 116, no. 4, Jan. 23, 1936, pp. 121–123. Concrete-arch bridge over Rio Grande between Laredo, Tex., and Nuevo Laredo, Tamaulipas, Mexico, twice overtopped, equipped with structural aluminum railings that are quickly and easily removed in contrast to old fixed railings, which dammed current and drift; cable anchorage at end of bridge; lighting standards, which are also removable, are placed over each pier.

Movable. Conditions d'éstablissement et bases des études des ponts mobiles, V. Cherre. *Annales des Ponts et Chaussées*, vol. 106, no. 1, Jan. 1936, pp. 28–90. Review of principles of design of movable bridges; classification of movable bridges; theory and methods of operation of movable bridges; kinematic analysis of operation of movable bridges, including description of operating equipment.

Piers, Construction. Kincardine-on-Forth Bridge. *Engineer*, vol. 161, nos. 4180 and 4181, Feb. 21, 1936, pp. 196–199, 204; and Feb. 28, pp. 220–222. Bridge in Scotland is nearly one-half mile long; description limited to work necessary to found and construct piers; bridge consists of central swing span, flanked on each side by seven 100-ft steel spans of cantilever construction; there are three 6[illegible]-ft steel spans carrying road over L. N. E. Railway, nine 50-ft reinforced concrete spans, and concrete piled viaduct, 263 ft long.

Piers, Foundations. Underwater Concrete Mixtures and Placement—San Francisco–Oakland Bay Bridge, S. M. Hands. *Am. Concrete Inst.—J.*, vol. 7, no. 3, Jan.-Feb., 1936, pp. 365–377. Concrete construction of bridge-pier foundations under salt water at depths varying from 25 to 242 ft; types of foundations; aggregate sources; type of concrete required; importance of fines; proportions; equipment; control of placing.

Plate Girder, Denmark. Storstroem Bridge. *Ry. Gaz.*, vol. 64, no. 12, Mar. 20, 1936, pp. 560–561. Structural details of new Danish railway bridge; superstructure for 47 approach spans is of steel plate girders, each 12 ft deep; spans are of cantilever type, anchor arms being 190 ft, cantilever arms 29 ft, and suspended spans 146 ft in length.

Steel Arch, South Africa. Chrome-Copper Steel Arch Spans, 1,080 Ft. *Eng. News-Rec.*, vol. 116, no. 7, Feb. 13, 1936, pp. 246–247. Description of Birchenough Bridge of Beit Railway Trust spanning Sabi River 100 miles east of Fort Victoria in single arch of 1,080-ft length and 216-ft rise; use of Chromador steel, containing chromium, manganese, and copper, resulted in weight of only 1,500 tons, which obviated necessity of placing foundations in treacherous sands.

Steel, Welding. Pont-rail soudé de 45 mètres de portée sur la Dema (U.R.S.S.), G. Nikolaev. *Ossature Métallique*, vol. 5, no. 2, Feb. 1936, pp. 72–78. Design and construction of welded railroad steel-truss bridge, of 45 m span, over Dema River in U.S.S.R.; results of laboratory tests of bridge members.

CITY AND REGIONAL PLANNING

Land Use. Land and Land Use, P. E. Brown. *Science*, vol. 83, no. 2154, Apr. 10, 1936, pp. 337–343. Review of land use in United States; land inventory and classification; removal of submarginal land from production; protection and regulation of use of land; land use and industry; land use and taxation.

New York. What Is America's Problem? Le Corbusier. *Am. Architect*, vol. 148, no. 2643, Mar. 1936, pp. 17–22. Unconventionally expressed ideas on plan for development of New York City.

Regulations. What We Are Gaining from Town Planning, H. S. Osborne. *Am. City*, vol. 51, no. 4, Apr. 1936, pp. 67–69. Land subdivision; improved zoning regulations; new type of apartment house zone; park and street plans; public interest.

Statutes. Preparation of Statutory Planning Scheme, J. T. Johnson. *Instn. Mun. & County Engrs.—J.*, vol. 62, no. 16, Feb. 4, 1936, pp. 853–867. Preliminary work; resolution stage; planning proposals; restrictions and reservations; preservation of trees and protection of woodland; discussion of proposals; final work on draft scheme; consultation with local authorities; adoption of draft scheme; submission of scheme to minister; notice of submission of scheme; challenge in High Court.

Tennessee. Tennessee Valley Activities Today, S. T. Henry. *Eng. News-Rec.*, vol. 116, no. 7, Feb. 13, 1936, pp. 238–239. Fundamental character of project; survey and summary of development of project; interrelation of vital development phases of project; bringing about better farming; industrial research; land utilization.

CONCRETE

Aggregates. Aggregate Production for Grand Coulee Dam, G. F. Dodge. *Am. Concrete Inst.—J.*, vol. 7, no. 3, Jan.-Feb., 1936, pp. 317–332. Mining and preparation of aggregates for dam which will contain more than 11,000,000 cu yd of concrete; arrangement of plant; flow sheet of materials handling.

Aggregates, Testing. Effect of Coarse Aggregate and Other Factors on Properties of Concrete, H. W. Coultas. *Structural Engr.*, vol. 14 (new series), no. 3, Mar. 1936, pp. 131–159. Tests made in laboratories of University of Birmingham; effect of time of mixing, rate of application of load, subsequent water storage, size, shape, and surface texture of coarse aggregates; effect of combination of sizes of gravel aggregates on strength, density, and slump of concrete; effect of coarse aggregate, composed of single-sized gravel, on volume change.

Curing. Effect of Curing Temperature on Compressive Strength of Concrete at Early Ages, J. C. Sprague. *Am. Concrete Inst.—J.*, vol. 7, no. 2, Nov.-Dec. 1935, pp. 212–218. Results of U. S. Engineer Office tests in which specimens were exposed to exactly same curing condition as that given concrete in field, and compared with those obtained from companion specimens cured in laboratory at 70 F and 100 per cent relative humidity. Bibliography.

CONSTRUCTION INDUSTRY

Equipment, Scaffolding. Echafaudages tubulaires. *Ossature Métallique*, vol. 5, no. 1, Jan. 1936, pp. 18–23. Review of recent American, British, and Belgian practice in design and construction of tubular scaffolding, particularly in building and in maintenance and repair of high towers.

DAMS

Concrete Gravity, Australia. Construction of Canning Dam, Western Australia, R. J. Dumas and V. Cranston. *Instn. Engrs. Australia—J.*, vol. 8, no. 1, Jan. 1936, pp. 1–14. Description of concrete-gravity dam, 218 ft high, for water works of city of Perth, Western Australia; details of concrete design and construction, drainage system, contraction joints, forms, etc.; cost data.

Concrete Gravity, Construction. Concrete at Norris Dam, I. L. Tyler. *Am. Concrete Inst.—J.*, vol. 7, no. 3, Jan.-Feb., 1936, pp. 285–297. Construction of Tennessee Valley Authority concrete-gravity dam 1,600 ft long and 254 ft in maximum height, with concrete core wall extending into east abutment; aggregates for concrete; flow sheets of plant operation; concrete production and placing; technical data; average strength of field mixed concrete.

Concrete Gravity, Washington. Concrete Mixing and Placing at Grand Coulee Dam. *Eng. News-Rec.*, vol. 116, no. 4, Jan. 23, 1936, pp. 119–120. Description of first of two duplicate mixing plants, each with capacity of 320 cu yd per hr, having floor area of only 42 sq ft, but total height exceeding 250 ft; batcher floor and automatic-control equipment.

Earth. Steel-Faced Dam Built by Colorado Municipality, F. O. Ray. *Western Construction News*, vol. 11, no. 3, Mar. 1936, pp. 66–67. Construction of earth-fill steel-faced dam, 92 ft maximum height, for Colorado Springs, Colo.; design details of steel facing and supporting system; method of welding steel plates.

Earth, Construction. Construction Procedure with Small Earth Dams, W. A. Hardenbergh. *Pub. Works*, vol. 67, no. 3, Mar. 1936, pp. 25–26. Review of modern practice; spreading and compacting; preventing erosion of earth surfaces.

Earth, Core Walls. Caverns Under Dam Core Wall Set Nice Repair Problem, F. Gannett. *Eng. News-Rec.*, vol. 116, no. 14, Apr. 2, 1936, pp. 492–494. Narrative report by contractor; water finds cavern that grouting missed and scours outlet under dike and core wall of Ontelaunee Dam of new water works at Reading, Pa.; repairing dam by blanketing with clay and by deeper cement grouting.

Earth, Soil Mechanics. Practical Soil Mechanics at Muskingum—I, T. T. Knappen and R. R. Philippe. *Eng. News-Rec.*, vol. 116, no. 13, Mar. 26, 1936, pp. 453–455. Practical application of soil mechanics in dam building; work done at laboratory of Muskingum project; groundwork for rational study; field sampling; tentative design; soil classifications.

Fishways. Fishways at Bonneville Dam to Cost $3,550,000. *Eng. News-Rec.*, vol. 11[illegible] no. 7, Feb. 13, 1936, pp. 235–237. Description of fishways providing six passages by which fish may pass dam en route to spawning grounds, including three pairs of locks, each with daily capacity of from 25,000 to 30,000 fish; water discharge in fishways, 5,650 cu ft per sec; collection facilities; traps and barriers; itemized costs.

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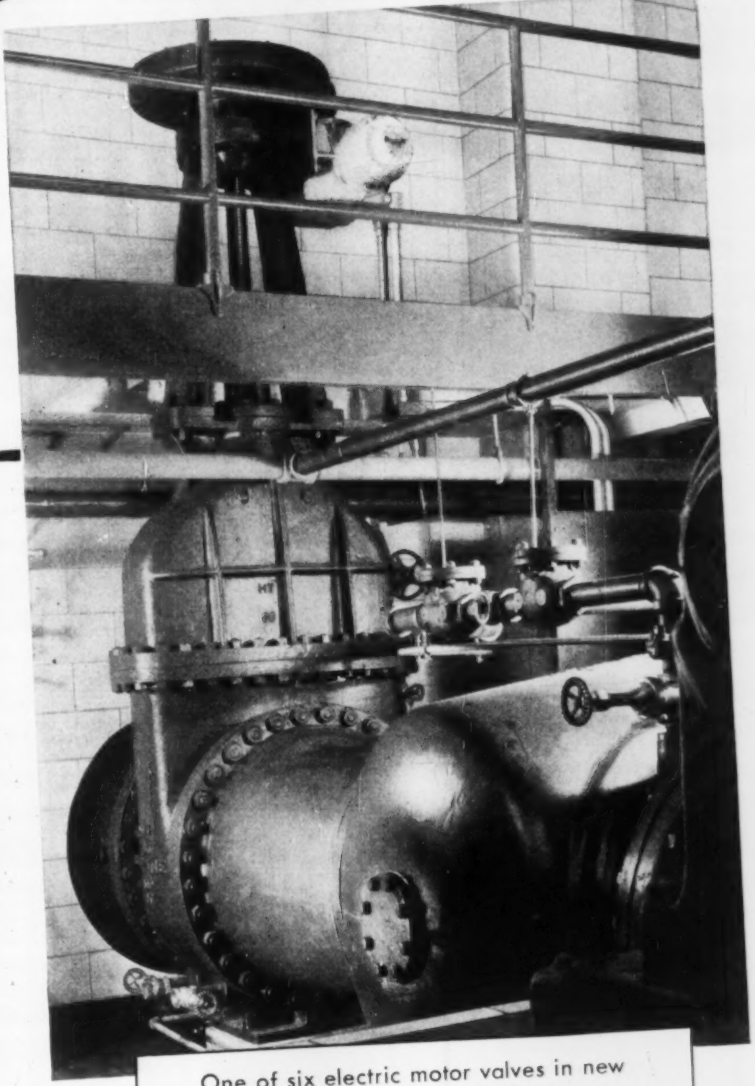

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Grouting. Reservoir Leakage. *Water & Water Eng.*, vol. 38, no. 461, Mar. 16, 1936, pp. 183–184. Data on recent cement grouting operations on several small British dams and reservoirs to stop leakage.

Reservoirs, Design. Fundamental Hydrologic Considerations for Design of Impounding Reservoirs in Middle West, E. L. Waterman, F. T. Mavis, and E. Soucek. *Am. Water Works Assn.—J.*, vol. 28, no. 2, Feb. 1936, pp. 193–206. Principles of design of small reservoirs in country of gentle topography and finely divided soil; analysis of Ralston Creek records; summary of rainfall and runoff records; comparison with analyses for New England streams; comparison of Ralston Creek analysis with records of Iowa reservoirs.

Rock Fill, California. Progress at San Gabriel Dam No. 1 on Modified Design, P. Baumann, Jr. *Eng. News-Rec.*, vol. 116, no. 4, Jan. 25, 1936, pp. 114–115. Revised plans have flatter slopes, call for removal of some rock already placed, provide for hosing rockfill in central zones, and contemplate use of material formerly wasted from Quarry 10.

Spillways, Construction. Fort Peck Dam Spillway Construction, H. R. Hardin. *Western Construction News*, vol. 11, no. 3, Mar. 1936, pp. 76–81. Description of design and construction of Fort Peck spillway; boring 467 holes of 5-ft diameter for concrete piles; cutting foundation shale with saws.

Weirs, Foundations. Les barrages fondés sur sol perméable, L. Dufour. *Technique Moderne*, vol. 27, no. 8, Apr. 15, 1935, pp. 253–256. Theory of weirs and low dams founded on permeable ground; laws of movement of water through pervious formations; review of German experiments on models.

FLOOD CONTROL

Rio Grande. Flood-Control Work in Rio Grande Delta. *Eng. News-Rec.*, vol. 116, no. 12, Mar. 19, 1936, pp. 407–411. Outline of international Lower Rio Grande flood-control project; work done by International Boundary Commission on levee repairs, protection of siphons carrying irrigation water under floodways and river bank protection at 13 bends; location for Mexican levees and proposed floodways; estimate of cost of completed flood-control project; irrigation; inlet controls.

United States. Engineering Reports on Record Floods from New England to Potomac. *Eng. News-Rec.*, vol. 116, no. 13, Mar. 26, 1936, pp. 441–446, and 466–469. Symposium on catastrophic flood of March 1936, which affected ten northeastern states: Johnstown Flood Rivals '89 Dam Break, H. W. Richardson; Pittsburgh Experiences Maximum Flood, N. B. Jacobs; Susquehanna Floods Highest on Record, H. W. Richardson; Hydrology of New England Floods, H. K. Barrows; New England Flood Exceeds That of 1927, V. T. Boughton; Hudson Crest Reduced by Reservoir, E. H. Sargent; Utility Damage in New England, H. S. Knowlton; Damage to Roads and Railroad Lines; Washington and Potomac, I. D. Foos.

FOUNDATIONS

Buildings, Subway Construction. Reprise en sous-oeuvre des immeubles, Deniau. *Travaux*, vol. 19, no. 31, July 1935, pp. 259–261. Review of French practice in underpinning and repair of buildings in path of subway construction, pipe and conduit laying, etc.; development of practice since 1910 and description of concrete cases.

Piles, Concrete. Behavior of Reinforced-Concrete Piles During Driving, W. H. Glanville, G. Grime, and W. W. Davies. *Instn. Civ. Engrs.—J.*, no. 2, Dec. 1935, pp. 150–202, (discussion) 203–234, 3 supp. plates. Theoretical and experimental investigation carried out at Building Research Station, with collaboration of Federation of Civil Engineering Contractors, initiated as result of troubles experienced while driving piles through hard stratum; outline of mathematical theory and description of test apparatus.

Testing. Field Testing Machine for Bearing Capacity of Soils. *Western Construction News*, vol. 11, no. 3, Mar. 1936, p. 87. Features of patented foundation testing machine with gas-actuated jack maintaining uniform loads during test period; cycle of load applications determines settlement characteristics.

Testing, Germany. Das dynamische Bodenuntersuchungsverfahren, A. Hertwig and H. Lorenz. *Bauingenieur*, vol. 16, nos. 25/26, June 21, 1935, pp. 279–285. Discussion of German dynamic methods of testing foundation; observation and measurement of vibrations in foundation sites, including torsional vibration; use of dynamic testing of foundations in practical construction.

INLAND WATERWAYS

Rivers, Development. Program of Initial Work on Central Valley Project in California. *Western Construction News*, vol. 11, no. 3, Mar. 1936, pp. 68–72. Project for development of resources of Sacramento and San Joaquin rivers in California for irrigation, flood control, navigation, salinity control, power generation, domestic and municipal supplies, manufacturing, hydraulic mining, and recreational purposes; main features of proposed large irrigation canals and two concrete-gravity dams 300 ft and 460 ft in maximum height.

Rivers, Erosion. Stream Fluting and Stream Erosion, J. H. Maxson and I. Campbell. *J. Geology*, vol. 43, no. 7, Oct.-Nov., 1935, pp. 729–744. Study of formation of longitudinal grooves or "flutes" in stream bed due to swiftly moving sand or silt-laden water currents; importance of stream fluting in fluvial erosion; process is analyzed on basis of excellent examples observed in inner gorge of Grand Canyon of Colorado River.

Rivers, Hydraulics. Essais sur modèles réduits pour des riviéres à fond mobile, M. Chadenson. *Annales des Ponts et Chaussées*, vol. 105, no. 6, June 1935, pp. 988–1019. Review of fundamental theory and of experimental work in European and American laboratories on models of rivers with shifting stream beds; application of model testing to improvement of Rhone River in France.

PORTS AND MARITIME STRUCTURES

Breakwaters, Failure. Stability of Vertical-Wall Breakwaters, B. Cunningham. *Engineering*, vol. 141, nos. 3656 and 3658, Feb. 7, 1936, pp. 140–142, and Feb. 21, pp. 211–213. Discussion, with reference to construction and failure, due to storms, of breakwaters at ports of Algiers and Catania, and to investigations carried out by E. C. Cagli, whose conclusions and deductions, based on his wide and prolonged experience in harbor design and construction, are presented.

Breakwaters, France. Les travaux d'amélioration du port de Saint-Malo, Saint-Servan. Prolongement du mole des Noires. *Travaux*, vol. 19, no. 31, July 1935, pp. 253–258. Design and construction of combined rubble-mound, concrete block, and encased rubble breakwater, about 14 m high, totaling 520 m in length, at port of St. Malo and St. Servan, France; details of rock products and concreting plants; total cost about 17,000,000 francs.

Breakwaters, Wave Effects. Wave Pressure Experiments at Genoa. *Engineer*, vol. 161, no. 4181, Feb. 28, 1936, pp. 222–224. With reference to experiments in progress at Genoa since 1931 to determine by actual measurement, pressures of waves on face of vertical wall breakwater in relatively deep water, brief account is given of instruments used in recording pressures and method of employment, based mainly on articles by A. Albertazzi and S. Levi, published in the May 1933 issue of *Annali dei Lavori Pubblici* and in the August 1934 issue of *Ingegnere*.

Railroad Structures, Harbors and Rivers. Report of Committee XXV—Waterways and Harbors. *Am. Ry. Eng. Assn.—Bul.*, vol. 37, no. 382, Dec. 1935, pp. 219–233. Definitions of terms; types of construction for levees, dikes, and mattresses for use under varying service conditions; economic principles involved in clearances over inland navigable waterways; clearances for structures over waterways; cost to railways for construction, maintenance, and operation of bridges over waterways.

Rye Bay, Sussex, England. Recent Maritime Works in Rye Bay, Sussex. *Engineering*, vol. 141, nos. 3652 and 3654, Jan. 10, 1936, pp. 27–30, and Jan. 24, pp. 81–83, supp. plates. Scheme adopted consisted of continuous groining for distance of 3 miles 5 furlongs; new groins are only 250 ft long, average spacing being 300 ft; pile-driving operations; illustrated description of sea-defense work.

ROADS AND STREETS

Brick. Old Concrete Road Revamped for New Brick Surface, R. M. Andrew. *Eng. News-Rec.*, vol. 116, no. 4, Jan. 23, 1936, pp. 127–130. Brick resurfacing between new concrete curbs of worn concrete pavement on road between Franklin and Greenwood, Ind. (U. S. 21); length of road to be renovated 8½ miles long; curb construction; establishing profile; renovating old slab; cushion construction; brick laying; joint filling.

Cement Bound. Recent Development of Cement-Bound Roads in Germany, W. von Meng. *Roads & Road Construction*, vol. 14, no. 157, Jan. 1, 1936, pp. 11–13. German adaptation of construction process used in Great Britain and in other countries since 1929.

Curves. Modern Road Transition Curves, L. R. Robertson and D. F. Orchard. *Instn. Mun. & County Engrs.—J.*, vol. 62, no. 19, Mar. 17, 1936, pp. 1003–1007. Principles of use of transition curves in alignment of roads.

Highway Engineering, Europe. Europe's Road Problem Mainly Maintenance. *Contractors & Engrs. Monthly*, vol. 32, no. 3, Mar. 1936, pp. 15, 26–27, 41, and 44. Review of construction and highway maintenance problems of Germany, Italy, the Soviet Union, and other countries of Europe.

Highway Engineering, Illinois. Papers Presented at Twenty-Second Annual Conference on Highway Engineering Held at University of Illinois February 21 and 22, 1935. *Univ. Ill. Bul.—Eng. Experiment Station—Cir. no. 25*, vol. 33, no. 24, Feb. 11, 1936, 119 pp. 50¢. University and State Highways (abstract), A. C. Willard; Planning Highway System to Meet Future Requirements: General Features and Conditions, C. E. DeLeuw; Present Status in Illinois, H. E. Surman; Some Economic Aspects of Highway Improvement (abstract), C. M. Thompson; Types of Low-Cost Bituminous Surfaces: Experiences and Practices in Missouri, C. P. Owens; Application to Conditions in Illinois, W. H. Flood; Practical Soil Stabilization: Report of Division of Tests, U. S. Bureau of Public Roads, C. A. Hogentogler; Report of Illinois Division of Highways, V. L. Glover; Stabilized Gravel Roads: Theory and Practice, C. M. Hathaway; Application to County Roads, E. L. Gates; Development of Roadside Quarries and Gravel Pits in Connection with Secondary Road Construction Experiences and Practices in Illinois, O. F. Goeke; Roadside Development: From Engineering Standpoint, P. Vogelsang, From Esthetic Standpoint, I. L. Peterson; Motor Fuel Tax Law as Applied to Cities and Villages: From Standpoint of Cities, M. P. O'Brien, From Standpoint of State, G. H. Baker; Remarks on Subject, V. H. Kasser; Contract vs. Day Labor in Use of M. F. T. Funds by Counties and Cities: From County Standpoint (abstract), R. F. Fisher, From County Standpoint (abstract), P. Lewis, From City Standpoint (abstract), C. F. Abraham; Road Ahead, C. C. Wiley.

Highway Engineering, Research. Experimental Work on Roads. *Roads & Road Construction*, vol. 13, no. 155, Nov. 1, 1935, pp. 368–372. Summary of 1934 annual report of British Ministry of Transport Technical Committee for Experimental Work on Highways; concrete; cement-bound macadam; tar and bituminous surfacing; surface dressing; footpaths in rural areas; other experimental work.

Highway Systems, Germany, Design. Germany Builds Express Highways, E. Zube. *Roads & Streets*, vol. 68, no. 6, June 1935, pp. 187–190. Outline of Germany's new 5,000-mile express highway system; design and construction features; construction difficulties encountered; landscaping the highways; highways will have no grade crossings; pavements in smaller cities; bicycle roads; tests of road building materials.

Highway Systems, New York. Rational Road Plan for New York. *Eng. News-Rec.*, vol. 116, no. 12, Mar. 19, 1936, pp. 424–425. Recommendations of New York legislative commission for long-time plan of highway improvement with definite allocation of expenditures amounting to $92,000,000.

Highway Systems, Pan American. Roads of Future in South America. *Contractors & Engrs. Monthly*, vol. 32, no. 2, Feb. 1936, pp. 11, 22–23, 32–33 and 44. Features of project for construction of Pan-American highway; route of proposed road through Argentine, Brazil, Chile, Ecuador, Peru, Colombia, Venezuela, Bolivia, Uruguay, and Paraguay; area and road mileage.

Highway Systems, Washington. Washington Modernizes Obsolete Sections of Major Highway, L. V. Murrow. *Western Construction News*, vol. 11, no. 3, Mar. 1936, pp. 63–65. Reconditioning of Tacoma-Olympia link in Pacific Highway, featuring record bridge project on Nisqually cutoff, including 4,000-ft concrete trestle.

Machinery. Performance of Key Equipment Used in Highway Construction, T. C. Thee. *Roads & Streets*, vol. 68, nos. 8, 9, and 10, Aug. 1935, pp. 251–255; Sept., pp. 291–295; and Oct., pp. 317–322. Highway engineer of Division of Management of U. S. Bureau of Public Roads reports results of practical investigation of performance of concrete pavers, power shovels, elevating graders, and asphaltic concrete mixers.

Maintenance and Repair. Street Maintenance on Badly Bent Budgets—III. *Am. City*, vol. 51, no. 3, Mar. 1936, pp. 71–72. Street officials report on 1935 work and 1936 prospects: Milwaukee, Wis., R. W. Gamble; Honolulu, Hawaii, B. F. Rush; Mishawaka, Ind., W. G. Wiekamp; Enid, Okla., C. B. Lewis; Bradford, Pa., J. H. Quirk.

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Dam constructed by Roesser & Pendleton, Inc., oil operators, on Clear Fork of Brazos River, near Lueders, Texas (shown below) was built in three sections. 'Incor', used on exposed sections, was service-strong in 24 hours, safe against sudden water rise days sooner than ordinary concrete. Also, by speeding completion, 'Incor' minimized bad-weather shut-downs.

Proximity Print Works (right), Greensboro, N. C., erected a new warehouse next to railroad siding. 'Incor', used in foundation to offset cave-in danger, was self-supporting in a fraction of the usual time.

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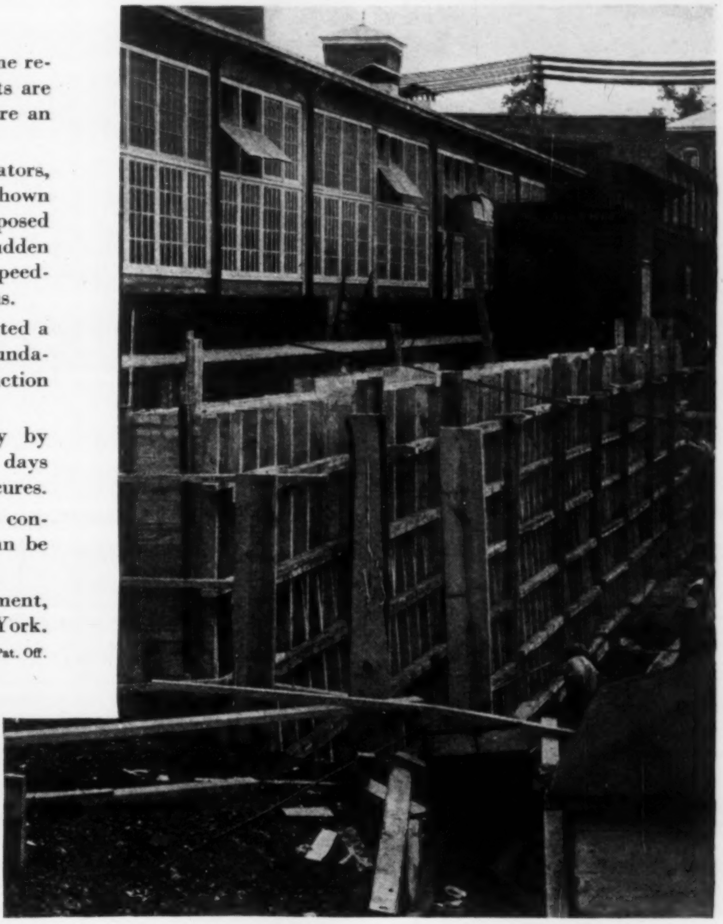

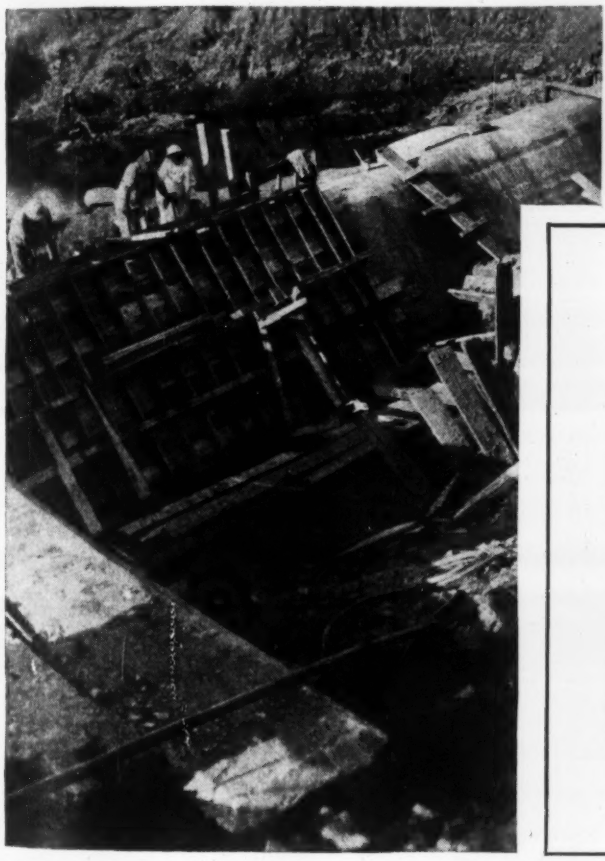

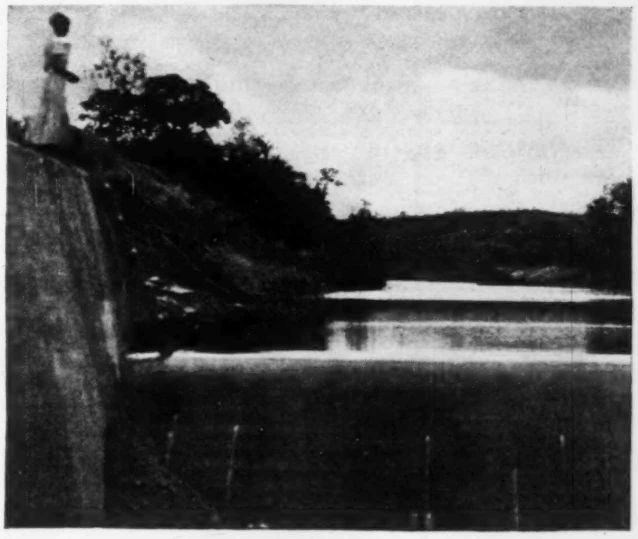

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INTERPRETATION OF SALARY REPORTS

In order to clarify the understanding of the reports on salaries printed under Society auspices, the following action was adopted by the Board of Direction on April 21, 1936:

"*Resolved*, that the reports of the Committee on Salaries, approved by the Board of Direction, wherein it was intended to set forth the prevailing rates of salaries of civil engineers as of the first quarter of 1934 and as published in CIVIL ENGINEERING, first in April 1934, later, in revised form, in August 1935, and again as a separate in May 1935, are

"(1) to be understood to be statistical studies of salaries current in 1930 and early 1934 among a large group of highway engineers; and

"(2) are to be understood to have been prepared to aid in improving the salaries then being paid engineers engaged on relief work; and

"(3) that the salaries indicated in those reports are not indicative of the higher salaries appropriately to be paid engineers at the present time."

This notice is being printed in such form and size that it may be conveniently clipped out and appended to all copies of these reports in the hands of members or others. Additional reprints of this notice are available on request at Headquarters.

33 West 39th St., New York, N. Y. June 1, 1936

WATER PIPE LINES

CORROSION. Eliminating Guess from Anti-Corrosion Treatment, P. L. McLaughlin. *Water Works Eng.*, vol. 89, no. 5, Mar. 4, 1936, pp. 247–249. Results of study made by West Virginia Water Service Co.; method developed for determining amount of lime required to correct waters of eight West Virginia communities; saturation point of nitre filtered water; treatment curve for Charleston, W.Va., based on alkalinity relation to pH at saturation point.

DISTRIBUTION SYSTEMS. Practical Problems in Water Distribution, E. W. Breitkreutz. *Am. Water Works Assn.—J.*, vol. 28, no. 2, Feb. 1936, pp. 180–192. Experiences in Los Angeles Water Bureau during past 22 years; valves; interference of other substructures; cast-iron fittings; fire hydrants; double mains.

WATER RESOURCES

UNDERGROUND, GERMANY. Ergebnisse achtzehnjaehriger Grundwasserbeobachtungen in Nordwestsachsen, R. Grahmann. *Braunkohle*, vol. 34, nos. 24 and 26, June 15, 1935, pp. 373–378, and June 29, pp. 441–448. Results of 18 years of observations of ground water in northwestern Saxony, from which conclusions are drawn regarding nature and causes of fluctuations in ground water.

UNITED STATES. Water Resources Studies, T. Saville. *Eng. News-Rec.*, vol. 116, no. 6, Feb. 6, 1936, pp. 220–222. Review of first results of coordinated movement to explore United States water resources and plan for their systematic conservation and utilization; reclamation policies; conservation activities in 1935; Water Resources Committee; Soil Conservation Service; current activities; future trends and potentialities.

WATER TREATMENT

FILTRATION PLANTS, POUGHKEEPSIE, N.Y. America's Oldest Filtration Plant. *Am. City*, vol. 51, no. 4, Apr. 1936, pp. 46–48. Description of present-day equipment of water filtration plant built in 1872, having capacity of about 6 mgd; features of sedimentation basin, filters, and aerators; lime treatment; high-lift pumps.

MODERN METHODS. Note sur la désacidification et la clarification des eaux potables, Guizerix. *Annales des Ponts et Chaussées*, vol. 106, no. 1, Jan. 1936, pp. 5–27. Review of modern practice of neutralization, filtration, and purification of water supplies; inconvenience of acid waters.

WATER WORKS ENGINEERING

ARTESIAN WELLS. Plugging Old Artesian Wells to Stop Underground Water Loss, T. M. McClure. *Eng. News-Rec.*, vol. 116, no. 12, Mar. 19, 1936, pp. 425–427. Conservancy district in New Mexico under state regulation cements off wells that cause leakage from artesian storages into upper strata; total of 114 wells plugged in 5 years; methods used in plugging; operation of equipment; regulations for drilling new wells.

MANAGEMENT. Obsolescence in Water Works Equipment and Operating Methods, W. W. Brush. *Am. Water Works Assn.—J.*, vol. 28, no. 2, Feb. 1936, pp. 207–213. General longevity and stability of water works structures; collection and storage of water; transportation system; distribution reservoirs and tanks; measurement of supply furnished to consumers; pumping stations; water treatment plants.

OPERATION. Waterworks Operators Along Lake Michigan Tell of Winter Trouble. *Eng. News-Rec.*, vol. 116, no. 13, Mar. 26, 1936, p. 452. Report of proceedings of meeting of West Shore Water Producers Association; cold-weather experiences told by operators of water works systems located on west shore of Lake Michigan; trouble with ice closing inlets; winter work at Milwaukee.

TROPICS. Water Supply Problems in Tropics of Spanish America, G. C. Bunker. *New England Water Works Assn.—J.*, vol. 50, no. 1, Mar. 1936, pp. 1–98, (discussion) 99–104. Hydrology, climate, and population of tropical countries of Central and South America, with particular reference to special water-supply problems; water works in Panama Canal Zone and Colombia; fire service in tropics; water-borne diseases and epidemics; water treatment; labor conditions; influence of sea water on location of intake. Bibliography.

UNITED STATES. Federal Interference Protested in Stream Pollution Control. *Water Works Eng.*, vol. 89, no. 5, Mar. 4, 1936, pp. 256–257. Proceedings of 1934 meeting of New England Water Works Association, including abstracts of papers and discussions on cold weather problems; inspection of hydrants; pension legislation; significance of B. Coli; regulating water pipes in buildings.

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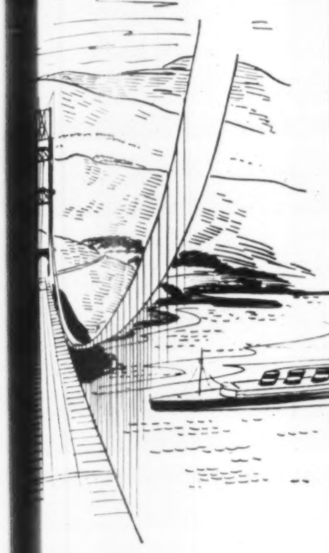

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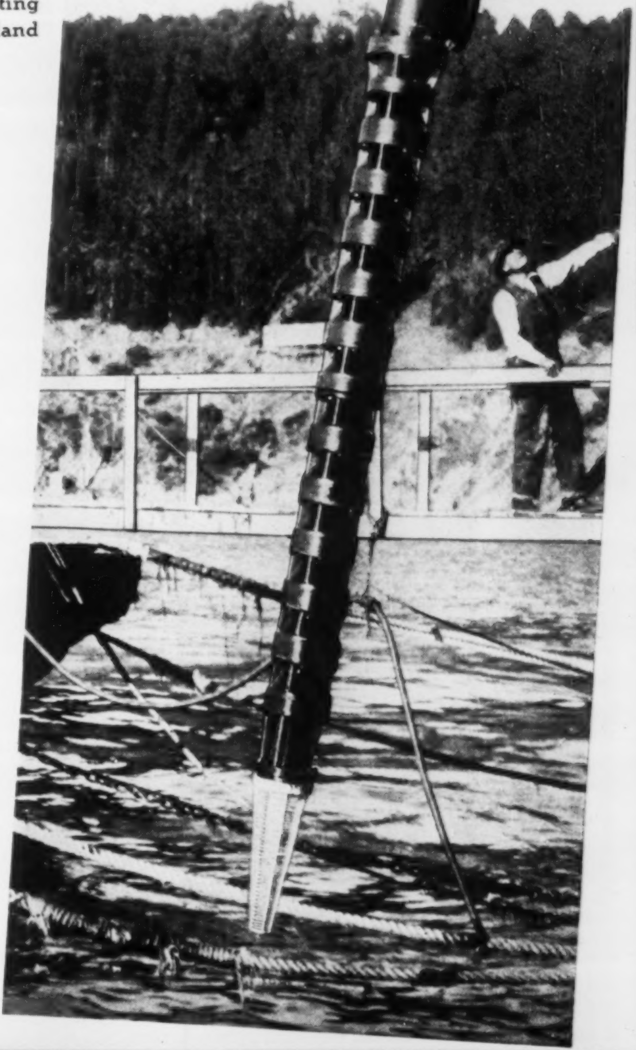

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New Developments of Interest, as Reported by Manufacturers

A New "Caterpillar" Diesel Auto Patrol

The Caterpillar Tractor Co. announces its new No. 10 Diesel Auto Patrol, the second road maintenance machine in the Company's line with a compression ignition engine. The new unit is powered with the same 4-cylinder, 4-cycle Diesel engine used in the RD4 tractor. This power plant, with a $4^1/_4$-in. bore and $5^1/_2$-in. stroke, develops 44 hp at governed speed of 900 rpm.

The new model is available with either tandem or single drive, according to the announcement. 7.00–20 tires are standard equipment on the front wheels and 11.25–24 low pressure tires are furnished on the rear wheels of the tandem drive model while the dual rear wheels of the single drive machine carry 9.00–24 tires. 12 ft blades are standard equipment on both machines. Full power control, which has long been an important Auto Patrol feature, is retained in this latest model. All operating controls of the blade and scarifier are accomplished through power control levers grouped directly in front of the operator's seat.

With the announcement of the No. 10 Diesel Auto Patrol, the larger machine formerly known simply as the Diesel Auto Patrol becomes the No. 11 Diesel Auto Patrol. Spark ignition as well as Diesel models will continue to be available in both sizes. The new No. 10 Diesel machine weighs approximately 15,600 lbs in the tandem drive model and 13,000 lbs with single drive. Both models are provided with four speeds forward and one reverse, the forward speeds ranging from 1.8 to 10 miles per hr.

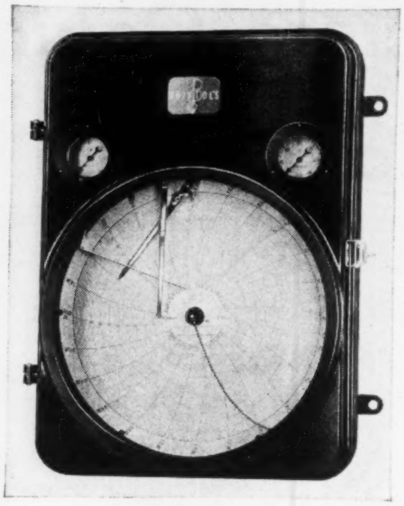
Spiral Welded Pipe Bulletin

Although it is entitled Bulletin No 101, the 60-page, $8^1/_2$ in. by 11 in. treatise issued by the Pipe Sales Division of the American Rolling Mill Company of Middletown, Ohio, might be considered a handbook on the subject of Armco Spiral Welded Pipe. Its table of contents gives a fair conception of the comprehensive material contained in its pages. The subjects listed are: The evolution of plate metal pipe; technical data on Armco Spiral Welded Pipe; municipal uses; advantages; joints, coatings; standard or special fittings; field installation data; hydraulics of pipe; and specifications. Illustrations of installations; line drawings of fittings; and tables, tabulations and charts of technical data all add to the value of this booklet.

Copies may be obtained without charge from the manufacturer.

New Recorder-Controller by the Bristol Company

The Bristol Company announces a new series of pneumatic-type controllers known as Ampliset Free-Vane Controllers. These instruments are now available for automatically controlling temperature, time-temperature, flow, liquid level, pressure, time-pressure, and humidity. The Ampliset principle has also been combined with the Metameter, a system of telemetering recently announced by this company, for the remote control of steam pressure and gas pressure.



In the Ampliset Controller certain features of field adjustability have been added to the Free-Vane System, whereby its sensitivity can be changed by means of a small screw driver to exactly fit the lag peculiarities of the process on which it is used. The sensitivity or throttling range of the instrument can be changed without removing the chart or chart dial. It can be changed without, in any way, disturbing the operation of the controller or upsetting the operation or equilibrium of the process. By the same adjustment that regulates the sensitivity of the Ampliset Controller, the instrument can be changed from direct-acting to reverse-acting or vice versa. This change is made by simply turning the scale on the adjustment past the zero point. Since the Free-Vane System requires practically no power from the measuring element to operate controlling mechanism, the chart record is always accurate.

This new instrument is described in Bulletin No. 440. Copies will be forwarded upon request to the Bristol Company, Waterbury, Conn.

New Subdrainage Bulletin

The current extensive damage to highways and streets by water and frost action, makes the new 32-page bulletin, "Subgrade Drainage for Modern Roadways," published by the Armco Culvert Manufacturers Association especially timely.

This bulletin summarizes the annually recurring damage and stresses the need for providing stable subgrades on new construction. The relation of soil studies to the problem is briefly described, and drainable and undrainable soils are defined. Various subgrade treatments are outlined including the use of admixtures and porous sub-bases, but emphasis is laid on drainage as being the fundamental requirement. Drainage is divided into two classes—interception drainage and drainage to lower the water table. Typical cross-sections and recommended installation practices are shown as well as numerous illustrations.

Copies of this bulletin, H-36, may be obtained by addressing the Armco Culvert Manufacturers Association, Middletown, Ohio.

Facts for Users of A.C. Motors

What are the prices of standard electric motors of various types and ratings? What is the distance between the motor mounting and the drive shaft of any one of these motors. What size wire should be used to connect the motor to the line?

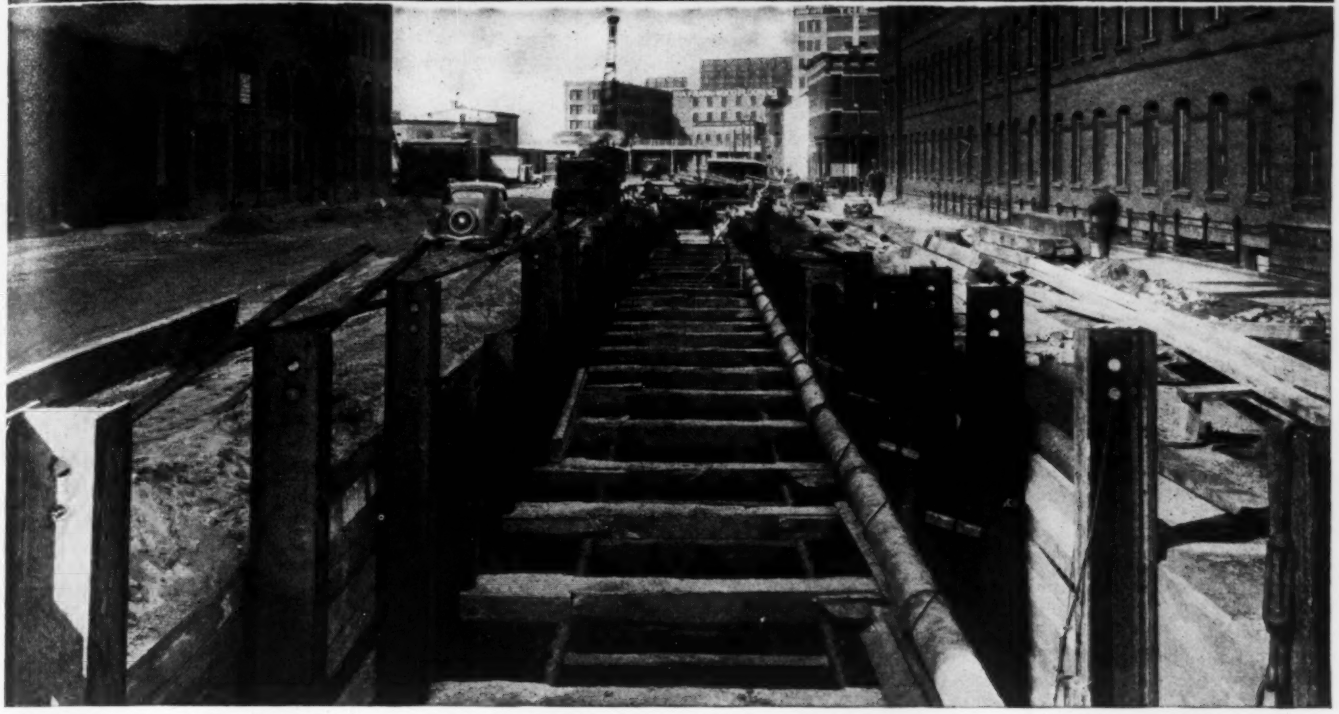
These are typical of the several hundred questions that are answered in the concise bulletin on the application of "Linc-Weld" general purpose motors. Copies of this bulletin may be secured, upon request, from the Lincoln Electric Company, Coit Road and Kirby Ave., Cleveland, Ohio.

Compressed Air After-Coolers

Sullivan Machinery Company announces a new bulletin (No. 88-W) describing the company's line of compressed air After coolers.

Features stressed are the multipass design which insures maximum cooling efficiency from the water available, the use of a built-in separator which effectively removes from the air the water and oil condensed in the After-cooler and the provisions made for quick easy cleaning of the cooling tubes. Request copies from Sullivan Machinery Company, Dept. 23, Michigan City, Ind.

BETHLEHEM *Steel* H-PILING



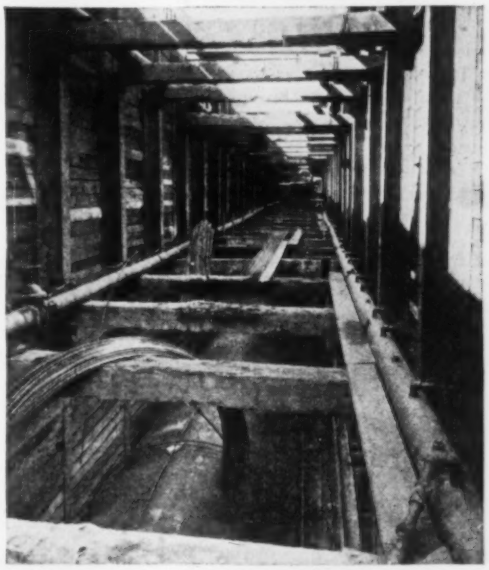
Open cut of new intercepting sewer on 133rd Street, between Alexander and Lincoln Avenues. Rodgers and Haggerty, Inc., General Contractors

simplifies intercepting sewer construction in New York City

WHEREVER subway, sewer or other sheeted-trench projects must be completed economically and with minimum delay, Bethlehem Steel H-Piling can be relied on to fill the bill. For example, take the new 30-ft.-deep 133rd Street Intercepting Sewer in New York City, where Bethlehem Steel H-Piling was used to brace the open cut between Alexander and Lincoln Avenues.

On this job, the H-piles, averaging 40 feet in length, penetrate from 5 to 10 feet below the sub-grade of the sewer. No difficulty was experienced in driving an average of 20 piles a day through sand and gravel at the rate of one inch per blow. Supporting columns are spaced at intervals of 8 feet, with the inside faces 13 feet apart. Bracing consists of three sets of 12 x 12 timbers, spaced approximately 10 feet apart. The bottom brace was removed when the sewer invert was poured.

Perhaps the most interesting feature of the entire project, however, was the highly economical method of sheeting the trench. Three-inch planks were used on the outside of the piling down to the water-line. Below that point, 4-in. planks were placed inside the flanges of the Bethlehem Steel H-Piling. Well points, to pump out the ground water, run down the outside planking. The economy and efficiency with which this intercepting sewer was constructed are typical of the results obtainable with Bethlehem Steel H-Piling in all types of sheeted-trench work. Although a comparative newcomer to the eastern states, Bethlehem Steel H-Piling is already widely accepted by progressive engineers. Its use merits mature consideration.



Showing method of planking and well points used to pump out ground water, running down outside planking.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

Fairbanks-Morse Propeller Pumps

A BULLETIN of 8 pages, $8^1/_2$ in. by 11 in. has been issued by Fairbanks-Morse & Company, 900 South Wabash Ave., Chicago, Ill.

This bulletin describes the efficiency of these propeller pumps in handling large quantities of water at low heads, their dependability, portability, freedom from complications of priming, and their subsequent wide range of application. Copies will be forwarded by the manufacturer upon request for Bulletin 6310.

New Single-Phase Induction Motor

ESPECIALLY designed for heavy industrial duty, a new single-phase repulsion-start induction motor is announced by Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The new Type CR motor has high starting and pull-in torques which make it particularly suitable for such applications as pumps, compressors, machine tools, door openers, etc. It is available in a complete line of ratings, $^3/_4$ to 3 hp, $^{110}/_{220}$ volts dual voltage for operation on all commercial frequencies.

The type CR starts as a repulsion and, because of the high torque developed, rapidly overcomes the relatively high inertia load to which this type of motor is usually subjected, and comes up to speed in a very short period of time. At approximately 60% of synchronous speed, the armature is short circuited by a centrifugally operated device, and the motor continues to operate as a squirrel cage induction motor. This results in a constant speed, irrespective of the load.

The motor is essentially a heavy duty motor. All cast parts are of heavy section with shafts and bearings of liberal proportions. All mechanical and electrical features have been designed with the intention of producing a general purpose single-phase motor that will give long life and trouble free operation even under the unfavorable operating conditions which frequently exist on applications where this type of motor is used.

Mixers and Agitators

THE 1936 Catalog of Rex Moto-Mixers and Agitators has been published by the Chain Belt Company, 1600 West Bruce Street, Milwaukee, Wis.

This 44-page catalog describes and illustrates Rex equipment units. Its eleven sections cover the application of the equipment to various types of construction throughout the country, and give specifications and dimensional drawings of the different sizes of mixers and agitators.

Copies of the catalog may be secured from the manufacturer upon request.

Austin-Western Badger Booklet

AN ILLUSTRATED booklet of 24 pages, $8^1/_2$ in. in size, on the Austin-Western Badger Shovel has been published by the Austin-Western Road Machinery Company.

GREATER OUTPUT
Speed · Stability
Dumping Height
Reach · Visibility
ECONOMY
PORTABILITY
CONVERTIBILITY
THREE-QUARTER SWING
AUSTIN WESTERN
Badger Shovel

It is claimed by the manufacturer that this $^3/_4$ swing Badger shovel, available for every kind of shovel work, not only handles more yds per hr than a full revolving shovel of even greater capacity, but is capable of handling many jobs which the older type cannot perform. Better visibility for the operator; far less operating cost; greater stability; extra reach; extra dumping height; and ability to operate successfully in places where it would be impossible to operate a full revolving shovel; are other superiorities claimed for this unit.

The booklet not only discusses and compares the features which are claimed to make this shovel an improvement, but discusses and illustrates the method of operating on all types of jobs. Copy of the booklet can be obtained by addressing the Austin-Western Road Machinery Company, Aurora, Ill.

New Oxy-Acetylene Cutting Attachment

A NEW oxy-acetylene cutting attachment known as the Oxweld Type CW-22 has been announced recently by The Linde Air Products Company, 30 East 42d Street, New York, N.Y. This new cutting attachment incorporates features of design and possesses a range and quality of performance which permit it to handle light sheet metal as well as all but the heaviest work at speeds and efficiency equal to those of the full-size cutting blowpipe. The attachment operates on low-pressure or medium-pressure acetylene with equally satisfactory results. Severe field tests have proved its capacity, stability, and endurance under all conditions.

The Type CW-22 cutting attachment can be used on either the Oxweld Type W-17 or W-22 welding blowpipe handle, thereby greatly extending the utility of these two popular blowpipes.

Threaded Cast Iron Pipe

SUPER-DELAVAUD Cast Iron Pipe is now being manufactured in "steel pipe sizes—3, 4, 5, 6, and 8 in." with threaded joints for pressure service for water, gas, steam, or similar liquids and gases; and drainage service. Pressure pipe is supplied in three classes; standard, extra-strong and double-extra-strong. Drainage pipe, used for waste, vent, and drain work, is a lighter pipe for use in buildings and elsewhere where a tight screw-coupled joint is needed.

Every piece of Super-deLavaud Cast Iron Pipe with threaded ends is subjected to a hydrostatic pressure test of 1000 pounds per sq in.

This threaded Super-deLavaud pipe can be used in conjunction with standard screw joint fittings of any make without the need of an adapter. It is readily machinable and may be drilled, tapped, cut, and threaded with the tools in the average plumber's and steamfitter's kit.

Further information will be furnished by the manufacturer.

Worthington Bulletins

SEVERAL bulletins, 4 pages, $8^1/_2$ in. by 11 in. have been published by the Worthington Pump and Machinery Corporation, Harrison, N.J. These bulletins illustrate, describe, and give rating and dimensional information on:

- "Monobloc" Centrifugal Pumping Units
- "Monobloc" Condensate Return Units
- Horizontal Single Piston Pumps
  - Type AA—for pressures up to 75 lb per sq in.
  - Type AC—for pressures up to 250 lb per sq in.
- "Freflo" Centrifugal Pumps for underpass drainage
- Balanced Multi-Stage Volute Centrifugal Pumps
  - Type UX—for boiler feed service
- Centrifugal Fire Pumps—Two Stage Volute
- Vertical Triplex Single-Acting Power Pumps

and an 8-page bulletin No. S-500-B 29 on Worthington Diesel Engines, Vertical Four-Cycle, Direct-Injection, Type C.

Copies of these bulletins will be forwarded by the manufacturer upon request.

New Allis-Chalmers Catalog Available

A NEW catalog of 24 pages, $8^1/_2$ in. by 11 in., describes in detail the Allis-Chalmers Model "L" tractors. Illustrations of the tractor and of its construction details, with complete information and specifications add to the value of the booklet.

Copies may be obtained from the Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

Crane 16-inch No. 353 Angle Valves in large sewage disposal plant.

CRANE
Standard
144
Iron Body Globe, Angle, and Cross Valves
Brass Trimmed or All-Iron
WORKING PRESSURE—125 pounds steam
TEST PRESSURES
12-inch and smaller
Shell test, 300 pounds hydrostatic
Seat test, 225 pounds hydrostatic
14 and 16-inch
Shell test, 250 pounds hydrostatic
Seat test, 175 pounds hydrostatic

Globe Screwed No. 350 Brass Trimmed No. 350½ All-Iron

Angle Screwed No. 352 Brass Trimmed No. 352½ All-Iron

Cross Screwed No. 362 Brass Trimmed

Globe Flanged No. 351, Brass Trimmed No. 351½ All-Iron

Angle Flanged No. 353, Brass Trimmed No. 353½ All-Iron

List Prices, Each

Built for

MINIMUM MAINTENANCE

When you standardize on Crane valves you make an investment in design, ruggedness and craftsmanship that pays real dividends in reduced maintenance.

This materially reduces operating costs and contributes to that dependability which is so essential in waterworks, filtration, sewage disposal and irrigation services.

Consider the Crane No. 353 Angle Valve, for example. It is sturdily built and strongly reinforced against wear at every vulnerable point. Renewable body seats, swivel-type regrinding discs and outside stem threads reduce maintenance to a minimum. The workmanship is the kind you can expect to find only in Crane valves.

Check purchase costs against valve and fitting maintenance costs and you will find Crane valves and fittings economical. There is a Crane branch or distributor in your city fully stocked and well manned to insure prompt, intelligent service and co-operation.

CRANE

CRANE CO., GENERAL OFFICES: 836 SOUTH MICHIGAN AVENUE, CHICAGO, ILL. • 321 EAST THIRD STREET, LOS ANGELES, CALIFORNIA

Branches and Sales Offices in One Hundred and Sixty Cities

VALVES, FITTINGS, FABRICATED PIPE, PUMPS, HEATING AND PLUMBING MATERIAL

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 25; single; B.S. in C.E., New York University, 1935. Experience in drafting, surveying, and sewer construction. Desires opportunity in any branch of civil engineering, preferably railroads, oils, sewers, and highway construction. Perfectly willing to start from beginning in order to get a thorough foundation. D-4979.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 24; single; B.S.C.E., Cooper Union Institute; 7 months as transitman on county map-making work; 6 months with New York Park Department as transitman and party chief on topographical surveying and construction layout. Desires opportunity in construction. Will locate anywhere. D-4889.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 23; single; B.S. in C.E., Kansas State College; 6 months experience as topographic draftsman, 3 months as rodman on highway construction work, 1 year with U. S. Engineers as hydrographic draftsman. Desires opportunity for hard work and just compensation. D-4754.

JUNIOR CIVIL ENGINEER; Jun. Am. Soc. C.E., 29; self-educated; 5½ years survey, location and construction work; 2 years drafting, computation, and design; 1½ years administrative work. Desires position with consulting or designing engineer. Excellent references as to ability and character. D-5045.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 31; married; 2 years at Purdue University; 1½ years at Massachusetts Institute of Technology. Experience covers responsible charge of all types of surveys (on highways and bridges). Triangulation, construction and design of highways, construction of parkways and bridges, and drafting—mechanical and topographical. Available on short notice. D-4475.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 22½; single; C.E., Rensselaer Polytechnic Institute, 1935; Sigma Xi; now temporarily employed by the New York Park Department (under WPA) as transitman on park layout and building construction. Desires opportunity in any branch of civil engineering; prefers design or construction. Location immaterial. D-4587.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 24; single; B.S. in C.E., Rhode Island State College; majored in bridge design, roads, and water supply; 2 years experience as industrial engineer; 2 years experience as instructor in "practical surveying." Location immaterial. Desires opportunity; excellent recommendations. D-4567.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 22; B.S. C.E., University of Wisconsin, 1934; now designing dams for government agency; 2 years experience on hydraulic projects; prefers position with construction contractor, or consulting engineer. Available on 15 days notice. Location and salary open. D-4866.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 3 years as chief of party on surveys, etc. In charge of road-construction project. Assistant engineer for 3 years on sewer construction project. Licensed engineer, state of New Jersey; 2½ years to date with U. S. Coast and Geodetic Survey as engineer. Second-order triangulation and leveling. Observer and recorder. D-4842.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 21; single; B.S. in civil engineering, Worcester Polytechnic Institute, 1935, with advanced hydraulics option; 7 months, transitman and chief-of-party, highway surveying. Now temporarily employed as civil engineer in connection with graveling of county roads. Work in construction preferred. Location immaterial. Available immediately. D-4856.

CIVIL ENGINEER; Jun. Am. Soc. C. E.; 27; single; B.S. in C.E., Drexel Institute of Technology, 1932; member of Tau Beta Pi Society; 3 years as draftsman-computer on parkway design; some structural drafting; 6 months as construction timekeeper and checker. Location immaterial; salary secondary. D-5050.

TEACHING

CIVIL ENGINEER; Assoc. M. Am. Soc. C.E.; 38; married; member S.P.E.E.; registered professional engineer and land surveyor; B.S., M.S., and C.E. degrees. Varied practical experience; ex-soldier; 6 years experience teaching structural theory and design, engineering mechanics, and other courses. Associate professor. Desires new location with greater responsibility and opportunity. D-5090.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1936. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

DIVIDENDS FOR CITIZENSHIP. By J. L. Dobbins. Los Angeles, New York, and San Francisco, Suttonhouse Ltd., 1936. 216 pp., tables, 10 × 6½ in., cloth, $2.50.

This book is the result of a two-year survey by the author of the economic causes of the depression. It includes a comparative criticism of established and proposed relief activities and an outline of corrective procedure. The author has based his plan on the belief that the depression involves more than the single feature of unemployment.

ELEMENTS OF YACHT DESIGN. By N. L. Skene. New York, Kennedy Bros., 1935. 244 pp., illus., diagrs., charts, tables, 10 × 6 in., cloth, $3.50.

In this book by an experienced naval architect the operations involved in designing a yacht are discussed concisely and practically. Yachts of all types are considered, and special attention is given to problems of speed, power, and suitable propeller.

THE FACTORY MUTUALS, 1835–1935. Providence, R.I., Manufacturers Mutual Fire Company, 1935. 384 pp., illus., tables, diagrs., maps, 9 × 6 in., cloth.

This story of the Manufacturers Mutual Fire Insurance Company touches on many interesting phases of American history in the past century. A résumé of the early history of insurance companies is given, and there is detailed information on fireproof construction, automatic fire extinguishing systems, inspection, policy forms, and similar subjects. Biographical sketches of Zachariah Allen, founder of the company, and of John Ripley Freeman, who was long and prominently identified with the organization, are included.

HYDROSTATICS, A TEXTBOOK FOR THE USE OF FIRST YEAR STUDENTS AT THE UNIVERSITIES AND FOR THE HIGHER DIVISIONS IN SCHOOLS. By A. S. Ramsey. Cambridge, University Press; New York, Macmillan Co., 1936. 169 pp., diagrs., 9 × 6 in., cloth, $2.35.

A text for beginners, which provides a simple course. Numerous problems are given, and some knowledge of calculus is required for an understanding of this volume.

INDUSTRIELLE HEIMSTÄTTENSIEDLUNG, der Weg zur Krisenfestigkeit des deutschen Arbeiters. By W. Wiedemann. Berlin, VDI-Verlag, 1936. 138 pp., illus., diagrs., charts, tables, 8 × 6 in., paper, 9 rm.

A concise discussion of the problem of housing workmen in Germany, with emphasis upon subsistence homesteads, residential colonies, etc. The practice of nine large German firms is described in detail.

LA OBRA DE LOS INGENIEROS EN EL PROGRESO DEL PERU. Ed. by A. B. Leguia and J. Balta. Vols. 1–4. Lima, Peru Moderno, 1929–1934. Illus., 9 × 7 in., paper, apply.

This work is a biographical encyclopedia of Peruvian engineers, in which their contributions to national affairs are emphasized. The biographies are accompanied by portraits.

LIVING TOGETHER IN A POWER AGE. By Samuel S. Wyer. New York, Association Press (347 Madison Avenue), 1936. 231 pp., illus., tables, diagrs., charts, 9 × 6 in., cloth, $2.50.

The author of this volume sees the way to a new order of plenty for all by way of social reconstruction through constitutional means. The book includes treatment of the causes of the depression; modern progress considered as a result of the substitution of fuel (partly in the form of power and transportation) for muscular effort; our change from a nation of individuals with individual rights to a nation of interdependent groups; the question of government ownership; and the fundamentals of the various proposed social systems.

MAINTENANCE OF TRACK. By E. E. R. Tratman, A. De Groot, and F. A. Cox. Scranton, Pa., International Textbook Co., 1934. illus., diagrs., tables, 8 × 5 in., leather, $1.25.

A textbook for track foremen, giving practical directions for trackwork of all kinds. A section on string lining of track is included.

PRACTICAL ASPECTS OF FLOOD CONTROL AND RECLAMATION OF OVERFLOWED LANDS. By Ashley G. Classen. Austin (Tex.), State of Texas Reclamation Department, 1935. 80 pp., illus., figs., diagrs., tables, 9 × 6 in., leather.

This brief treatise on flood control and reclamation is a source of pertinent information on the development of flood control and prevention projects on the smaller rivers and streams. Taking cognizance of the progress made in the practice of flood control and reclamation during the past twenty years, it deals with the proper design of floodways and channels and the interior drainage of levee-improvement districts. It also attempts to point out the chief causes of mistakes in these improvements and methods of avoiding them.

PRINCIPLES OF PLAIN AND REINFORCED CONCRETE CONSTRUCTION. By E. Probst. London, Edward Arnold & Co.; New York, Longmans, Green & Co., 1936. 344 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $10.

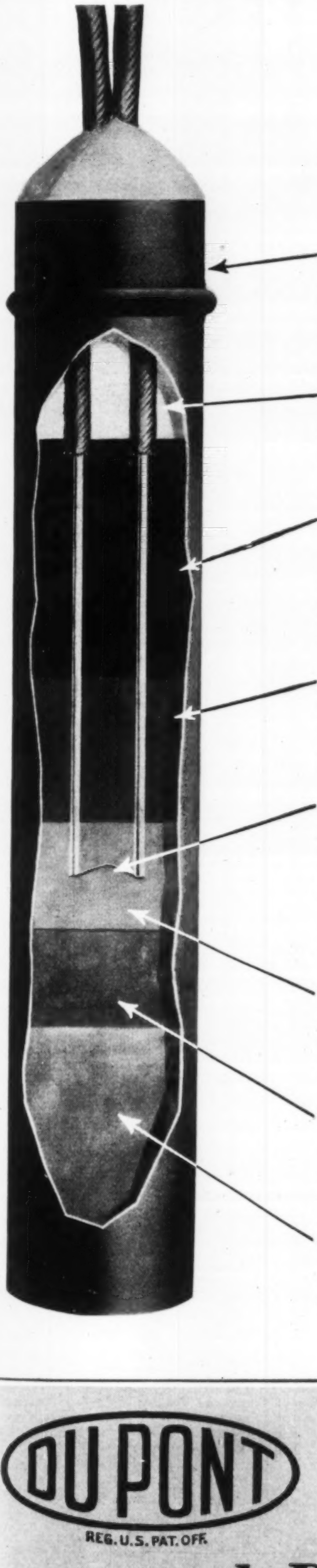
This translation of Dr. Probst's treatise is a useful addition to the literature. It aims to provide a survey of the development in theory and practice of plain and reinforced concrete structures. The first part is devoted to the properties of the materials, the second part to the fundamentals of the statics of reinforced concrete structures, and the third part to the measurement of strains and stresses in concrete dams. The more important fundamental considerations are discussed, and the sources of possible failures are emphasized.

TEXTBOOK OF THE MATERIALS OF ENGINEERING. By H. F. Moore; with a chapter on Concrete by H. F. Gonnerman; and a chapter on the Crystalline Structure of Metals, by J. O. Draffin. 5 ed. New York and London, McGraw-Hill Book Co., 1936. 419 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $4.

The physical properties of the common materials used in structures and machines, together with descriptions of their manufacture and fabrication, are presented concisely in suitable form for use as a college textbook. The new edition has an added chapter on failure by corrosion and wear; the chapter on failure by "creep" has been largely rewritten; and revisions and additions have been made throughout the book.

UNDERWRITING MANUAL — Underwriting and Valuation Procedure Under Title II of the National Housing Act. Washington, D.C., Federal Housing Administration (U. S. Government Printing Office), 1936. 124 pp., illus., tables, diagrs., charts, 9 × 6 in., cloth.

The purpose of this manual is to prescribe uniform and sound techniques, and to promote a broad understanding of the underwriting and valuation principles and procedure adopted and advocated by the Federal Housing Administration. It outlines the procedure to be followed by underwriting departments in insurance offices.



CROSS SECTION SHOWING STURDY, DEPENDABLE CONSTRUCTION

COPPER SHELL
Carefully annealed to prevent cracks. Dipped in lacquer before loading for detection of "pin holes."

SULPHUR SEAL
Specially compounded sulphur. Will not corrode copper nor eat insulation on leg wires.

WATERPROOFING
Efficient waterproof compound. Sticks to shell and leg wires, thus preventing moisture from creeping along leg wires and shell. Will not shrink in cold.

PLUG
Holds leg wires precise distance apart, relieving possible strain on bridge wire.

BRIDGE WIRE
Amazing example of precision manufacture. *Fifteen ten-thousandths* of an inch in diameter. Composed of four alloys to give right resistance to assure positive, dependable detonation.

IGNITION CHARGE
Ignites when bridge wire fuses. Will not corrode bridge wire, soldered joints or leg wires.

PRIMING CHARGE
Dense, powerful explosive that insures detonation of base charge at maximum velocity.

BASE CHARGE
Detonates at highest velocity of any commercial explosive.

DU PONT ELECTRIC BLASTING CAPS

Insure Complete Detonation of Your Shots

MONEY and time are required to prepare a shot. Don't risk losing both. Use an electric blasting cap that insures a complete detonation.

Du Pont Electric Blasting Caps are precision-built and sturdily constructed to withstand handling in use and transportation; long storage, and submersion in water. They are the world's largest-selling electric blasting caps. More than Nine Hundred Million have been used in the past twenty-five years.

E. I. DU PONT DE NEMOURS & CO., INC.
EXPLOSIVES DEPARTMENT, WILMINGTON, DEL.

BRANCH OFFICES: Birmingham, Ala.; Boston, Mass.; Chicago, Ill.; Denver, Colo.; Duluth, Minn.; Huntington, W. Va.; Joplin, Mo.; Juneau, Alaska; Kansas City, Mo.; New York, N. Y.; Pittsburgh, Pa.; Portland, Ore.; Pottsville, Pa.; St. Louis, Mo.; San Francisco, Calif.; Scranton, Pa.; Seattle, Wash.; Spokane, Wash.; Springfield, Ill.; Wilkes-Barre, Pa.

DU PONT REG. U.S. PAT. OFF. **EXPLOSIVES**

and Blasting Accessories

CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Magazines in This Country and in Foreign Lands

Selected items from the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file in The Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own file, from your local library, or direct from the publisher. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page, plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

Concrete Arch, Construction. Nailed Timber Centering for Concrete-Arch Bridges in Russia, E. L. Chlebnikov. *Eng. News-Rec.*, vol. 116, no. 16, Apr. 16, 1936, pp 563–564. Construction of nailed timber centering for erection of reinforced concrete arches (up to 262.5 ft in span) of highway bridge over Angara River near Irkutsk, Siberia; box units of boards and timbers assembled into arches with three concrete hinges for spans up to 135 ft carry loads of 8,700 lb per ft; method of striking centering on crib in center of concrete-arch span; principles of design.

Construction, Fire Prevention. Report of Committee on Construction Operations. *Nat. Fire Protection Assn.—Advance Publ. Mtg.*, May 11–14, 1936, 16 pp. Recommended good practice requirements for safeguarding against fire hazards during construction of bridges and tunnels.

Design. Statics of Bridge Design, G. Dunn. *Concrete & Constr. Eng.*, vol. 30, no. 12, Dec. 1935, pp. 697–709. Design of bridge abutments, including ordinary type of mass abutments with battered face on front, mass type foundations with vertical front face, cellular type of abutment; numerical examples.

Design, France. Quelques négligences dans le calcul des ponts, Moreau. *Travaux*, vol. 19, no. 32, Aug. 1935, pp. 345–347. Review of matters often neglected in bridge design, such as secondary stresses in floor, participation of uprights in bending of floor girders, and similar factors.

Highway, Quebec. Highway Bridges Constructed Recently in Quebec Province, O. Desjardins. *Can. Engr.*, vol. 69, no. 21, Nov. 19, 1935, pp. 5–8. Procedure to be followed before beginning construction on large bridges; characteristics of each structure.

Rigid Frame. Development and Use of Rigid-Frame Highway Bridge, E. R. Graydon. *Can. Engr.*, vol. 69, nos. 7 and 9, Aug. 13, 1935, pp. 5–9, and Aug. 27, pp. 3–7. August 13: Development of rigid-frame bridge; comparison with girder and arch bridges; typical cross-sections of rigid frames. August 27: Conditions of controlling various methods of design; skew rigid-frame bridge; summary of design of Schomberg bridge; design suitable for grade-crossing elimination. Prize thesis awarded by University of Toronto.

Steel, Design. Ueber die Erhoehung der zulaessigen inanspruchnahme von staehlernen Brucken, F. Hartmann. *Zeit. des Oesterreichischen Ingenieur- u. Architekten-Vereines*, vol. 87, nos. 21–22, and 23–24, May 31, 1935, pp. 125–128, and June 14, pp. 135–138. Review of factors of safety in design of steel bridges and plea for raising allowable working stresses in them.

Steel, Welding. Reinforcing and Reconstructing Bridges and Other Steel Structures by Welding, G. J. Driver. *Welding Engr.*, vol. 21, no. 4, Apr. 1936, pp. 38–40. Author states that it is imperative that plans for proposed welding work be complete in every detail, and that uniform and definite procedure for qualification of welding contractors, welding operators, and welding inspectors be established.

Suspension, Golden Gate. Golden Gate Bridge Construction Problems, A. F. McLane. *Western Machy. & Steel World*, vol. 27, no. 3, Mar. 1936, pp. 68–71. Problems involved in erecting towers.

Suspension, Oregon. Timber Stiffening Trusses for Suspension Bridge of 345-Ft Span, W. D. Smith and R. K. Krausse. *Eng. News-Rec.*, vol. 116, no. 14, Apr. 2, 1936, pp. 484–487. Design and construction of highway suspension bridge over Rogue River in Siskiyou National Forest, Ore., having stiffening truss of creosoted timber designed for high degree of rigidity in span of 344 ft 8 in.; erection procedure.

BUILDINGS

Foundations. Reprise en sous-oeuvre des immeubles, M. Brice. *Travaux*, vol. 19, no. 30, June 1935, pp. 211–219. Review of development of French practice in construction and repair of foundations of buildings since 1910, including several concrete examples described in detail.

CITY AND REGIONAL PLANNING

Diagrams. Grundlagen eines Raumzeit-Messverfahrens, M. H. Joli. *Zeit. des Oesterreichischen Ingenieur- u. Architekten-Vereines*, vol. 87, no. 35/36, Sept. 6, 1935, pp. 211–214. Method of construction of space-time diagrams for use in planning settlements and towns.

Exhibitions. Le quatrième Salon de la Société Française de Urbanistes, G. Bardet. *Travaux*, vol. 19, no. 32, Aug. 1935, pp. 321–328. Review of principal exhibits of fourth show of Société Française des Urbanistes, including reproductions of proposed city plans for Havana, Cuba; Lisbon, Portugal; and other cities.

Tennessee Valley Authority. Planning of Town of Norris, T. B. Augur. *Am. Architects*, vol. 148, no. 2644, Apr. 1936, pp. 18–26. Planning of town of Norris, Tenn., to provide housing for some 1,500 men engaged in building of Norris Dam; development of site and its control; house plans; administration, educational, and social buildings.

CONCRETE

Aggregates, Slate Waste. Lightweight Aggregate Produced from Slate Waste, E. H. Coleman. *Concrete Bldg. & Concrete Products*, vol. 11, no. 3, Mar. 1936, pp. 47–48, and 50. Results of analyses and tests made by Building Research Station of Great Britain; use of slate-waste aggregate in construction of partition slabs.

Disintegration, Causes and Prevention. Deterioration of Portland Cement Concrete, W. Watson and Q. L. Craddock. *Cement & Cement Manufacture*, vol. 8, no. 7, July 1935, pp. 165–173. Causes of cracks and disintegration and preventive measures. Bibliography.

Disintegration, Recent Literature. Deterioration of Concrete Structures in Alkaline and Sea Water, W. Watson and Q. L. Craddock, *Cement & Cement Manufacture*, vol. 8, no. 5, May 1935, pp. 130–141. Review of recent literature. Bibliography.

Protective Coatings. Schutz on Beton im Meerwasser, R. Gruen. Tonindustrie-Ztg., vol. 59, nos. 96, 97, and 98, Nov. 28, 1935, pp. 1185–1186. Dec. 2, pp. 1202–1203; and Dec. 5, pp. 1213–1215. Protection of concrete in sea water; discussion of two different methods—namely, impregnation of concrete with compounds which react chemically on cement content of concrete, and protective coatings for concrete.

Tanks. Prestressed Reinforcement for Domed Concrete Tanks, J. M. Crom. *Eng. News-Rec.*, vol. 116, no. 16, Apr. 16, 1936, p. 555. Description of concrete tanks built at paint company plant in which reinforcing rods have been prestressed, with result that considerable loads are carried by relatively thin sections and that cracks from tension and shrinkage are eliminated; use of concrete-dome roofs 60 ft in diameter, which carry central concentrated load of 20 tons.

DAMS

Arch. Scope of Constant-Angle Arch Dam, R. A. Sutherland. *Engineering*, vol. 141, nos. 3665 and 3667, Apr. 10, 1936, pp. 387–388, and Apr. 24, pp. 441–443. Discussion of whether or not arch dam should be attempted at any given site.

Concrete Gravity, France. Un des plus grands barrages d'Europe. Le Barrage du Chambon (Isère). *Travaux*, vol. 19, nos. 31 and 32, July 1935, pp. 245–249, and Aug., pp. 329–344, 3 supp. sheets; see also English abstract in *Eng. News-Rec.*, vol. 115, no. 26, Dec. 26, 1935, pp. 876–877. Design and construction of Chambon concrete-gravity dam in southeastern France, 450 ft maximum height, which makes it highest dam of any type in old world; cable tramway, 6.6 miles long, used to handle materials to isolated site; fissured ledge extended excavation 160 ft below stream bed; 2 miles of grout holes required to seal foundations.

Earth, Failure. Solving Dam Break by Deduction, P. E. Green. *Eng. News-Rec.*, vol. 116, no. 16, Apr. 16, 1936, pp. 556–558. Determination of cause of failure of earth dam, of 40-ft maximum height, at Herrin, Ill., from raingage records, runoff calculations, and levels of remaining structures; rainfall runoff as estimated by various formulas; deducing cause of settlement.

Earth, Soil Mechanics. Practical Soil Mechanics at Muskingum—II, T. T. Knappen and R. R. Philippe. *Eng. News-Rec.*, vol. 116, nos. 15 and 17, Apr. 9, 1936, pp. 532–535, and Apr. 23, 1936, pp. 595–598. Destabilizing effect of seepage; questions of piping; testing for permeability coefficients; model studies of seepage; value of model studies; resisting strength of foundations; increasing density of soil under applied loads; stress-strength relationship in foundation of proposed embankment; determining foundation stresses; photo-elastic stress determination; relationship between computed consolidation of foundations during construction and consolidation that actually took place at Clendening Dam.

Hydraulic Fill, Tennessee Valley Authority. Construction Steps Up at Pickwick, Third TVA Dam. *Eng. News-Rec.*, vol. 16, no. 16, Apr. 16, 1936, pp. 549–554. Symposium on construction of power and navigation dam consisting of hydraulic-fill embankment 4,700 ft long and of concrete spillway section 1,155 ft long: Dredge Pump Operations, S. T. Henry; Pickwick Landing Concrete Plant, H. F. Gough.

Reservoirs, Surveying. Control Surveys in Norris Dam Reservoir, G. D. Whitmore. *Military Engr.*, vol. 27, no. 154, July-Aug. 1935, pp. 275–279. Specifications for survey of reservoir site of Tennessee Valley Authority; monuments; leveling on range-line monuments; profiling ranges; accuracy in taping; establishing plane coordinates; methods of adjustment; typical triangulation figures.

Spillways, Design. Design and Application of Siphon-Spillways, C. D. H. Braine. *Can. Engr.*, vol. 69, no. 26, Dec. 24, 1935, pp. 3–7. Special reference to smaller installations employed in land drainage, canal regulation, waste-weirs, storm water overflows in sewers, relief of river floods, and similar factors. (To be continued.)

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Spillways, Drum Gates. Drum Gates at Madden Dam, W. L. Hersh. *Military Engr.*, vol. 28, no. 158, Mar.-Apr. 1936, pp. 123–128. Description of four steel drum gates, 100 ft long and 18 ft high, designed as watertight buoyant vessels; provision for draining gates through armored flexible hose connecting each end of all gates with drain piping embedded in concrete; minimizing shrinkage due to welding; method of operation.

Weirs, Movable. Neuere Klappenwehre und ihre Steuerungen, F. Hartung. *VDI Zeit*, vol. 80, no. 10, Mar. 7, 1936, pp. 277–280. New collapsible weirs and their control; discussion of most desirable designs and special features; design details and illustrations of drive and control of collapsible parts.

FLOOD CONTROL

Discharge. Relation of Rainfall to Flood Runoff, C. R. Pettis. *Military Engr.*, vol. 28, no. 158, Mar.-Apr. 1936, pp. 94–98. Mathematical expressions for effect of rainfall and other factors on magnitude of flood discharges.

Flood-Relief Works. Effect of Flood-Relief Works on Flood-Levels Below Such Works, E. C. Hillman. *Instn. Civ. Engrs.—J.*, no. 6, Apr. 1936, pp. 393–411, (discussion) 412–440. Study of reasons for change in flow conditions downstream of flood-relief works; effects on unprotected areas due to elimination of flooding from protected areas above them; effect of by-pass-channel flow on flood levels; use of reservoirs for flood relief; effect of uncontrolled reservoir storage; size of uncontrolled storage reservoir.

Germany. Der Hochwasserschutz der Stadt Breslau, Wechmann. ***Bautechnik***, vol. 13, no. 24, June 7, 1935, pp. 299–302. Flood-protection system of Breslau, Germany, which is situated largely on islands formed by arms of Oder River; features of open weirs, sluices, flood channels, and pumping plants.

New England. Mopping Up After New England Floods, E. J. Cleary. *Eng. News-Rec.*, vol. 116, no. 16, Apr. 16, 1936, pp. 566–571. Cities in the valleys of the Connecticut and Merrimac scrape debris from their sidewalks and buildings, clean filter-beds and sewer lines, rehabilitate homes, plan bridge and street replacements, and repair dikes and walls that can never again be regarded as sufficient flood protection.

Pennsylvania. After Floods in Pennsylvania Region, H. W. Richardson. *Eng. News-Rec.*, vol. 116, no. 17, Apr. 23, 1936, pp. 599–603. Notes on floods of the upper Ohio River and in the Susquehanna Valley that took place in March 1936: extent of flood; highway and street damage; WPA aid; water supplies, health, and safety; flood control plans; railroad lines restored rapidly; municipal conditions.

Warning Systems. Flood Warning System at Madden Dam, R. Z. Kirkpatrick. *Military Engr.*, vol. 28, no. 158, Mar.–Apr. 1936, pp. 88–90. System installed in Panama Canal Zone; reason for warning system; flood warnings during construction of dam; maintenance and operation of system; performance in recent flood.

FLOW OF FLUIDS

Open Channels. Zeichnerische Ermittlung von Stau- und Senkungslinien, O. Willmitzer. *Bauingenieur*, vol. 16, nos. 27/28, July 5, 1935, pp. 299–306. Development of graphical and analytical methods for tracing surface curve of stream without making any assumptions or approximations, under conditions of both uniform and variable flow.

Weirs. Sugli stramazzi di misura circolari, F. Rampani. *Energia Elettrica*, vol. 13, no. 2, Feb. 1936, pp. 51–58. Comparative study of calibration curves for circular, rectangular, and triangular weirs, including results of original experiments performed at Hydraulic Institute of University of Padua, Italy.

FOUNDATIONS

Bridge Piers, Repairs. Underpins Old Masonry Pier Under Severe Difficulties. *Ry. Eng. & Maintenance*, vol. 32, no. 5, May 1936, pp. 295–298. How forces on central region of Canadian National Railway successfully repaired foundation and encased base of large old stone masonry bridge structure, which had been seriously undermined by scouring action of current, in spite of heavy riprap protection.

Cofferdams, Mississippi River. Mississippi River Cofferdams, H. G. McCormick and J. W. Dixon. *Military Engr.*, vol. 28, no. 158, Mar.-Apr., 1936, pp. 105–108. Construction of large cofferdams for system of locks and navigation dams of 9-ft channel project of upper Mississippi River, now under way; model experiments to determine effect of penetration in reducing seepage; change in method of pumping cofferdams; time curves of seepage rate.

Piles, Composite. Composite Foundation Piles, A. M. Bouillon. *Military Engr.*, vol. 27, no. 154, July-Aug. 1935, pp. 291–296. Design and driving of piles consisting of unit of two or more sections, usually of different materials, connected by splice (lower part commonly of timber and upper part of concrete), cast in place or pre-cast; inherent hazards; comparison of types; precautions to be observed; inspection; proportioning mixture and lengths; danger of overloading; two recent jobs described.

Piles, Concrete. Cast-in-Place Concrete Piles, A. M. Bouillon. *Military Engr.*, vol. 27, no. 155, pt. 1, Sept.-Oct. 1935, pp. 387–391. Features of representative American types; hazards of uncased piles; tendency to heave; advantages of cast-in-place piles; disadvantages.

Piles, Driving. Institution Research Committee. Joint Sub-Committee on Pile-Driving. *Instn. Civ. Engrs.—J.*, no. 6, Apr. 1936, pp. 587–592.—Notes and practical suggestions on pile-driving; nature of stresses; head conditions; foot conditions; measurement of equivalent elastic set; estimation of stresses; hammer weight in relation to size of piles and similar factors; peak-stress indicator; impact strength of concrete and reinforced concrete; improvements in head cushion; necessity for care in details; bearing capacity.

Piles, Trial Driving. Determination of Length of Pre-Cast Piles, M. D. Kharegat. *Concrete & Constr. Eng.*, vol. 30, no. 11, Nov. 1935, pp. 638–640. Outline of method of using information from trial piles by plotting system of contours interpolated from toe levels of trial piles.

HYDRO-ELECTRIC POWER PLANTS

Design. Recent Practice in Hydro-Electric Power Development, B. Hellstrom. *Engineer*, vol. 161, nos. 4179, 4180, 4181, 4182, 4183, 4184, 4186, 4187, and 4188, Feb. 11, 1936, pp. 181–182; Feb. 21, pp. 207–209; Feb. 28, pp. 235–237; Mar. 6, pp. 248–250; Mar. 13, pp. 276–279; Mar. 20, pp. 304–307; Apr. 3, pp. 370–372; Apr. 10, pp. 382–383; and Apr. 17, pp. 406–409. Feb. 14–Mar. 6: Hydrology and duration curves; variations of water level; wind effect; discharge measurement; duration curves of flow and power; regulation of Lake Vanern. Mar. 13–Mar. 20: Concrete dams. Apr. 3: Layout of plants. Apr. 10: Architectural considerations. Apr. 17: Lower Svir development in Russia.

Tidal Power Plants, Maine. Tidal Power at Passamaquoddy. *Eng. News-Rec.*, vol. 116, no. 17, Apr. 23, 1936, pp. 583–590. History and description of Passamaquoddy tidal power scheme in Maine; tides at Eastport; tidal power projects; available power in present project and international scheme; alternate proposals; principal cost elements of Cooper plan; government plan; reservoir changes; main dams; housing; core drilling.

HYDROLOGY, METEOROLOGY, AND SEISMOGRAPHY

Rock Compressibility. Measurement of Compressibility at High Pressures and High Temperatures, F. Birch and R. R. Law. *Geol. Soc. Am.-Bul.*, vol. 46, no. 8, Aug. 31, 1935, pp. 1219–1250. With particular reference to determinations of velocities of propagation of elastic waves in materials of earth's crust; apparatus described was developed for measuring linear compressibility and its temperature coefficient; preliminary results for lead, aluminum, fused silica, obsidian, and artificial diabase glass. Bibliography.

INLAND WATERWAYS

Rivers, Improvement. St. Johns River Jetties, L. A. Murr. *Military Engr.*, vol. 27, no. 155, pt. 1, Sept.-Oct. 1935, pp. 376–377. Method of construction of two converging rubblestone jetties, in Florida; north jetty is 14,300 ft long and south jetty, 11,183 ft long.

IRRIGATION

Indo-China. Irrigations de la province du Nghe-An, Hanriot. *Arts & Métiers*, no. 185, Feb. 1936, pp. 22–29. Description of Vinh system for irrigation in Nghe-An Province, Indo-China; details of diversion works, irrigation and navigation canals, regulators, and similar features; costs.

Pumping Plants, Egypt. Pumping Stations in Upper Egypt, A. Steiner. *Concrete & Constr. Eng.*, vol. 30, no. 9, Sept. 1935, pp. 515–521. Structural design of three plants pumping water from Nile River, each equipped with two electrically driven pumping sets, capable of supplying 480,000 gal per hr and one electrically driven set with capacity of 280,000 gal per hr; details of reinforced concrete box foundation; reinforced concrete raft.

PORTS AND MARITIME STRUCTURES

Control. Future of Port Control with Special Reference to Possibilities of Grouping, D. J. Owen. *Inst. Transport—J.*, vol. 17, no. 5, Mar. 1936, pp. 273–278, (discussion) 279–285. Main features of problem; present control of ports, with special reference to British ports.

Corrosion. Deterioration of Structures in Sea Water. *Engineering*, vol. 141, no. 3663, Mar. 27, 1936, pp. 352–354; see also *Engineer*, vol. 161, no. 4187, Apr. 10, 1936, pp. 394–395. Review of fifteenth report of Committee of Institution of Civil Engineers on deterioration of structures of timber, metal, and concrete, when exposed to action of sea water.

Harbors, New York. Will New York Retain Her Position as First Port of United States? G. W. Grupp. *Naut. Gaz.*, vol. 126, no. 8, Apr. 11, 1936, pp. 5–6, and 30–31. Latest available statistics on water-borne cargo tonnage; battle of ports; rise of Port of New York; advantageous location; causes for delays; future rival of New York.

New York. Fifteenth Annual Report. *Port of N. Y. Authority—Annual Report*, Dec. 31, 1935, 74 pp., 3 supp. sheets. Financial and statistical data; statements on development and protection of port, construction of Midtown Hudson Tunnel and George Washington Bridge, operation of interstate vehicular crossings.

Shore Protection, Florida. Conservation of Florida Beaches and Waterways—General Plan of Organization and Financing, G. A. Youngberg. *Florida Eng. Soc.—Bul.*, no. 10, Apr. 1936, 15 pp. Florida shores and beaches; length of beach; conditions favorable for extensive formation of beaches; defensive program; inland waterways; recreational boating; legislation; county organization; state board of control for ports, waterways, and beaches; financing.

Steel Breakwaters. Development of Steel Breakwaters, W. F. Heavey. *Military Engr.*, vol. 27, no. 154, July-Aug., 1935, pp. 252–257. Economy of cellular-steel, sheet-piling breakwater construction in United States; construction of Calumet breakwater, which is 5,025 ft long, and of Fairport breakwater, which is 500 ft long.

Strasbourg, France. Les travaux d'extension du port de Strasbourg, R. Graff. *J. de la Marine Marchande*, vol. 17, no. 850, July 18, 1935, pp. 1303–1311. Illustrated description of extensions to port of Strasbourg, including oil terminal, cargo-handling equipment, warehouses, silos, docks, new entrance to port, and similar features.

Terminals, Fire Prevention. Report of Committee on Operation of Marine Terminals. *Nat. Fire Protection Assn. Advance Publ. Mtg.*, May 11, 1936, (Mar. sec.) 8 pp. Recommended practice for operation of marine terminals.

ROADS AND STREETS

Cast Iron. Iron Highways. *Engineer*, vol. 161, no. 4185, Mar. 27, 1936, pp. 341–342. Editorial contribution recommending wider use of cast iron for highway construction; it is claimed that adverse criticisms are not of serious character and are offset by important advantages.

Construction. Der Bau von Autobahnen durch Moorgebiete, E. Zill. ***Bautechnik***, vol. 13, no. 29, July 5, 1935, pp. 400–402. Review of methods of construction of automobile highways in swampy regions; cost estimates.

Frost Damage. Some Examples of Frost Boils Occurring on Alberta Highways, K. A. Clark. *Can. Engr.*, vol. 69, no. 11, Sept. 10, 1935, pp. 7–10. Cause of heaving explained and remedial measures described for five frost boils examined in southern Alberta; studies in practical application of soils mechanics.

Highway Accident Prevention. Safer Roads Will Reduce Accident Death Toll, D. G. Savage. *Safety Eng.*, vol. 71, no. 4, Apr. 1936, pp. 151–152. Highways that raise accident rates in view of traffic changes which they are called upon to carry, and for which they are not designed, are at fault; 15 points of highway design, which should be incorporated in existing highways by reconstruction and modernization, and included in design of all new highways.

Highway Systems, Denmark. £28 Million Danish Road and Rail Scheme. *Ry. Gaz.*, vol. 64, no. 15, Apr. 10, 1936, pp. 705–708. Brief description of project which involves two 11-mile, high-level bridges and directly connects Germany, Denmark, and Sweden by railway and road.

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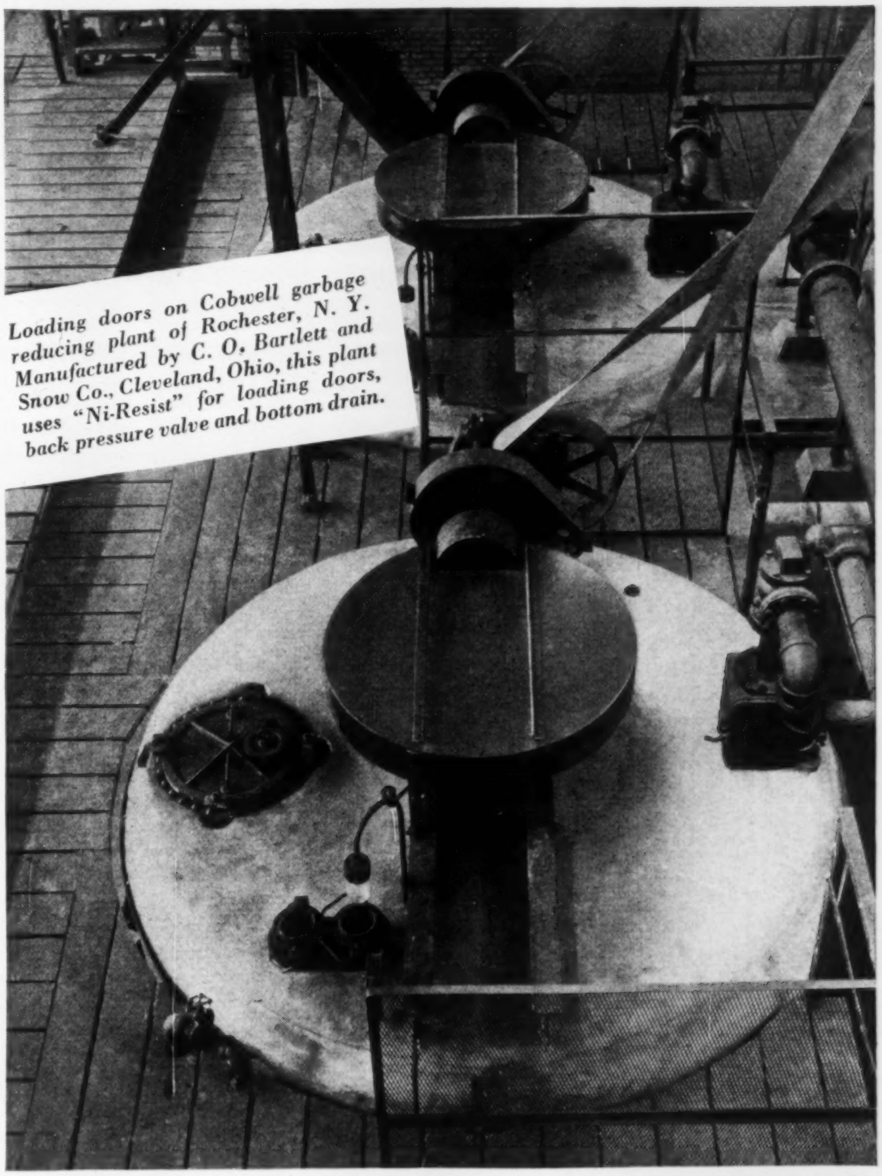

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MOUNTAIN. Perkins Memorial Drive—5-Mile, $1,357,000 Work Relief Project, A. B. Greenleaf. *Roads & Streets*, vol. 68, no. 6, June 1935, pp. 203–206. Design and construction of tourist highway up Bear Mountain, N.Y.; landscape architecture; roadside improvements; quantities and cost.

OILING. Oiled Road Construction in Wyoming, J. B. True. *Pub. Works*, vol. 67, no. 3, Mar. 1936, pp. 9–10. Experience of Wyoming State Highway Department; construction cost per mile of oiled roads; road-mix types; importance of subgrades; maintenance costs; mileage of state highways.

PERSIA. Road Building Activity in Iran, F. L. Fink. *Roads & Road Construction*, vol. 13, no. 153, Sept. 2, 1935, pp. 281–282. Recent progress in modern road construction in Persia.

RAILROAD CROSSINGS, GATES. Automatic Gates Tested by Burlington, W. F. Sane. *Ry. Signaling*, vol. 29, no. 4, Apr. 1936, pp. 207–211. Eight months' service, including severe winter, shows satisfactory results on project at Rochelle, Ill.; auto-manual control; operating features of gates; control of electric circuits; circuits for auto-manual control; construction details; economic statement; conclusions based on test; requirements for automatic highway crossing gates.

RAILROAD CROSSINGS, SIGNALS AND SIGNALING. Committee VIII—Highway Crossing Protection. *Assn. Am. Railroads—Proc. (Signal Sec.)*, vol. 33, no. 1, mtg., Mar. 9 and 10, 1936, pp. 304–308. Train-approach signals; development in highway-crossing protection; federal and state activities.

SALT STABILIZATION. Experimental Stabilization in Ohio, J. W. Reppel. *Roads & Streets*, vol. 68, no. 12, Dec. 1935, pp. 377–380. Report on Ohio Department of Highways experimental study of stabilization of foundations which involved rigid control of proportions, use of commercially prepared fire-clay binder and of salts, and placing of completed mixtures on comparatively new grade.

SALT STABILIZATION, METHOD. Stabilization of Gravel Roads. *Eng. & Contract Rec.*, vol. 49, no. 19, May 8, 1935, pp. 386–389. Calcium chloride used as binding medium; preliminary tests; construction procedure; maintenance; gravel compaction and dust elimination; preserving original crown and thickness.

SALT STABILIZATION, RESEARCH. Stabilized Soil Road Surfaces. *Roads & Road Construction*, vol. 14, no. 157, Jan. 1, 1936, pp. 14 and 15. Matter in film phase; high density and enormous cohesion of adhesive films; essential constituents of graded materials; essential design requirements; calcium chloride as dust layer and moisture stabilizer. Abstract from Progress Report of Project Committee on Stabilized Soil Road Surfaces, Highway Research Board, U.S.A., Division of Engineering and Industrial Research, 1935. Bibliography.

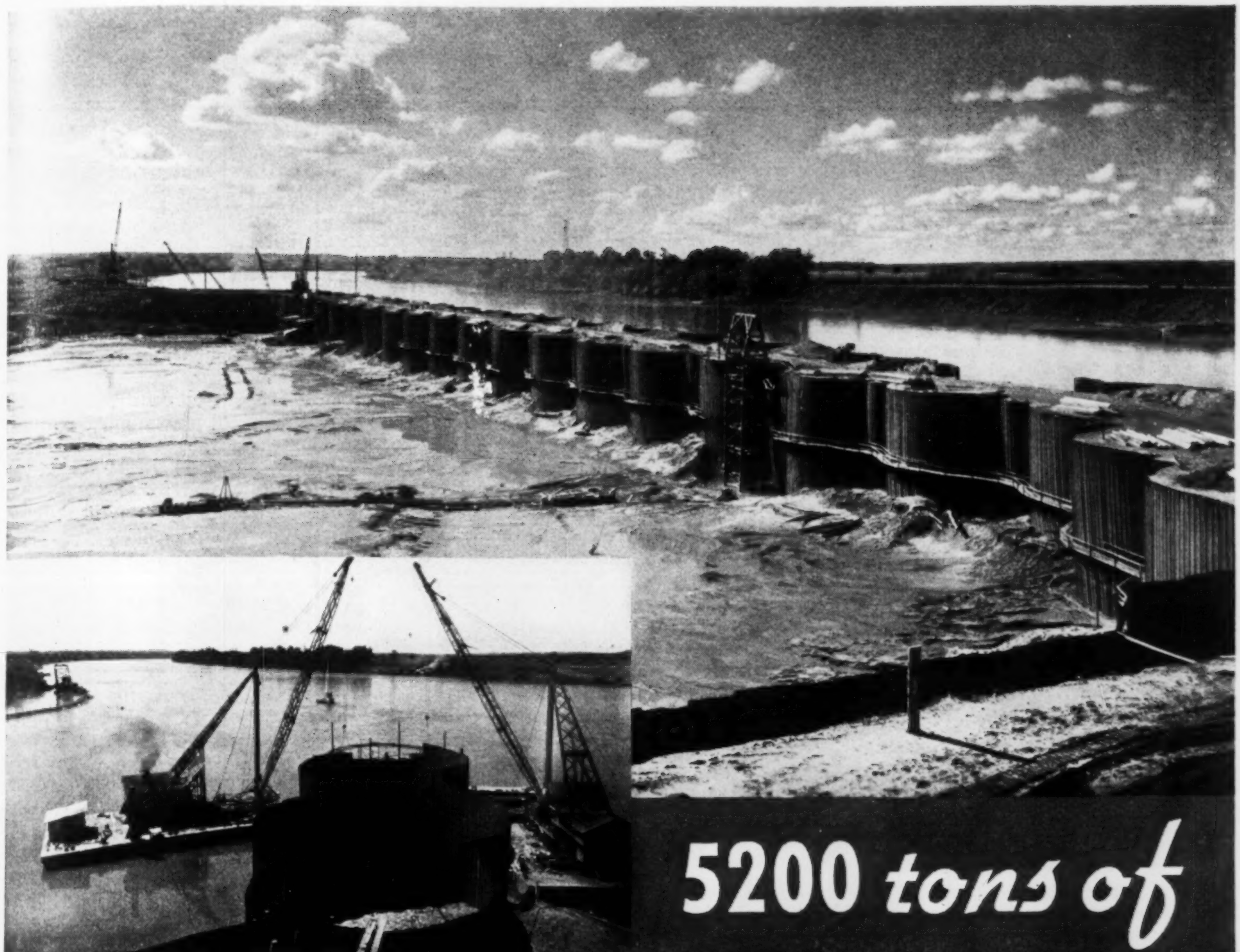
SLAG. Stabilized Slag on Detroit Streets, C.D. Warner. *Am. City*, vol. 51, no. 3, Mar. 1936, pp. 75–76. Work Progress Administration constructs 50 miles of stabilized slag wearing courses, using ready-mixed clay-stabilized slag, supplied by plant specially designed to produce this material; wearing course; mixing plant.

SEWERAGE AND SEWAGE DISPOSAL

CHEMICAL PROCESS, BIRMINGHAM, ALA. Experiences with Chemical Treatment of Sewage at Birmingham, Alabama, H. H. Hendon. *Sewage Works J.*, vol. 8, no. 2, Mar. 1936, pp. 231–247. Discussion of operating results, costs, and difficulties encountered from Jan. 1 to Dec. 31, 1935, together with results of experimental work on chemical precipitation of sewage conducted in central laboratory at Easley Plant; reagents needed to produce desired pH; sludge concentration; partial treatment. Bibliography. Before N. Y. State Sewage Works Assn.

CITIES. Sewage Disposal Problems for Large City, W. D. Turner. *Can. Engr.*, vol. 69, no. 24, Dec. 10, 1935, pp. 5–8. Merits of various methods of treatment; description of bio-reduction system; characteristics of bio-loam.

PLANTS, AUSTRALIA. Sewage Disposal Works of Adelaide, South Australia. *Engineer*, vol. 161, no. 4188, Apr. 17, 1936, pp. 412–413, and 416. New treatment works at Port Adelaide designed to treat 2,600,000 gal daily; suction gas engines superseded by automatically operated electric motors; sludge digestion carried out in two stages; in Glenelg treatment works area drained comprises 15,000 acres and is residential except for winery and distillery; treatment consists of preliminary settlement in hopper bottom tank followed by activated-sludge treatment.



5200 tons of

BETHLEHEM *Steel Sheet* PILING

in Pickwick Landing Project

AT Pickwick Landing Dam on the Tennessee River the problem was to build a dam and a lock for the navigable channel. A cofferdam was needed which would be economical to construct yet amply strong to withstand the full force of the river.

A cellular cofferdam, approximately 1500 feet long, was built of 15-in. x 3/8-in. Bethlehem Straight-Web Sections (SP6). Each of the circular cells was 59 ft. in diameter and was filled with sand and gravel removed from the lock bed. 50-ft. sections of Bethlehem Steel Sheet Piling were used on the lock side of the cofferdam and 55-ft. sections on the river side—both lengths of piling being driven to bed rock. A total of 5200 tons of Bethlehem Steel Sheet Piling was used in this project.

This Pickwick Landing Cellular Cofferdam, one of the largest ever constructed, is but one of numerous similar projects in which Bethlehem Steel Sheet Piling is being used throughout the country. The great size of the cofferdam and the ease and rapidity with which it was built are indicative of the efficiency with which many types of foundation work may be executed with Bethlehem Steel Sheet Piling.

BETHLEHEM STEEL COMPANY, *General Offices:* Bethlehem, Pa. *District Offices:* Albany, Atlanta, Baltimore, Boston, Bridgeport, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Hartford, Honolulu, Houston, Indianapolis, Kansas City, Los Angeles, Milwaukee, New York, Philadelphia, Pittsburgh, Portland, Ore., Salt Lake City, San Antonio, San Francisco, St. Louis, St. Paul, Seattle, Syracuse, Washington, Wilkes-Barre, York. *Export Distributor:* Bethlehem Steel Export Corporation, New York.

BETHLEHEM STEEL COMPANY

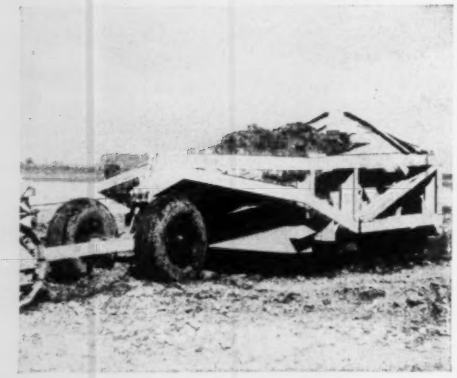
BETHLEHEM STEEL

Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

Austin-Western Announces a New 5-Yd Scraper

A NEW, low-cost, single cable scraper for use with tractors of thirty-five to fifty horsepower has just been announced by the Austin-Western Road Machinery Co. of Aurora, Ill.



An effective saving in operating costs is claimed by the manufacturer because the front and rear of the scraper pan are in the same plane while digging so that the earth moves back freely with the forward travel of the tractor. The scraper cuts to a depth of 6 in. and spreads the load evenly to any depth up to 9 in. Ample digging and dumping clearance eliminates choking between the cutting bit and the front gate, and despite over-loading, permits dumping while the tractor is traveling in high gear.

An interesting feature of the new machine is the fact that it performs every operation of digging, carrying, and dumping through the action of a single cable mounted on a vertical winch which requires no fair-lead and is automatically locked in place when the clutch is in neutral. This simplified control permits the scraper to be coupled and ready for operation in a brief time, and according to the manufacturer's claim also represents a saving in cost of maintenance.

The wheels are placed so that they travel within the six foot cut of the scraper instead of on either side. Truck type tires are used on all four wheels, permitting easy replacement at low cost.

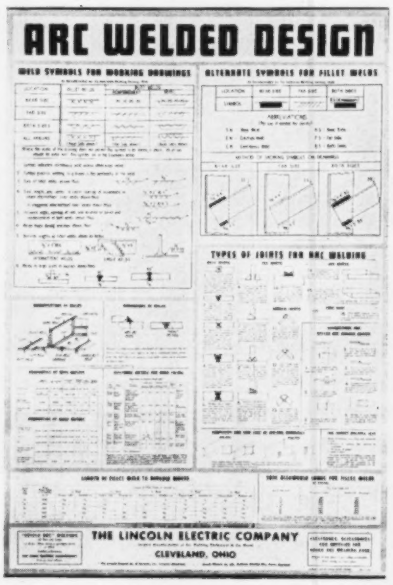
New Drainage Products Catalog

"DRAINAGE Products" is the title of a 48-page catalog recently published by the Armco Culvert Manufacturers Association. The principal products described include Armco corrugated pipe, paved invert pipe, standard and Hel-Cor perforated pipe, connections and fittings, Multi-Plate pipe and arches, part circle culverts and Calco drainage gates. Besides, there is current information on "Where drainage is needed," "Uses of Armco Ingot Iron Pipe," strength, durability, and installation economy; also, how to determine culvert sizes.

Free copies may be obtained by addressing the Armco Culvert Manufacturers Association, Middletown, Ohio, or any of its member companies.

New Arc Welded Design Chart

A NEW engineering drafting-room chart which presents in concise ready-reference form data necessary for producing arc-welded designs is announced by The Lincoln Electric Co. Data given on the Lincoln arc-welded design chart include weld symbols for working drawings; illustrations and particulars regarding the 16 types of joints for arc welding; illustrated suggestions for better arc-welded design; sketches explaining the nomenclature of welds and weld dimensions; a comparison of welded and riveted drawings; and tables giving properties of base metals, weld metals, electrode metals for hard facing, length of fillet weld to replace rivets, and safe allowable loads for fillet welds in shear.



ARC WELDED DESIGN

WELD SYMBOLS FOR WORKING DRAWINGS

ALTERNATE SYMBOLS FOR FILLET WELDS

TYPES OF JOINTS FOR ARC WELDING

THE LINCOLN ELECTRIC COMPANY

CLEVELAND, OHIO

The chart is 24 in. wide by $35^1/_2$ in. high with a metal strip across top and bottom and a clip for attachment to the wall. Engineers or men in charge of drafting rooms may secure a copy by writing The Lincoln Electric Co., Welding Engineering Department, Cleveland, Ohio.

Catalog Describes Auto Patrol Line

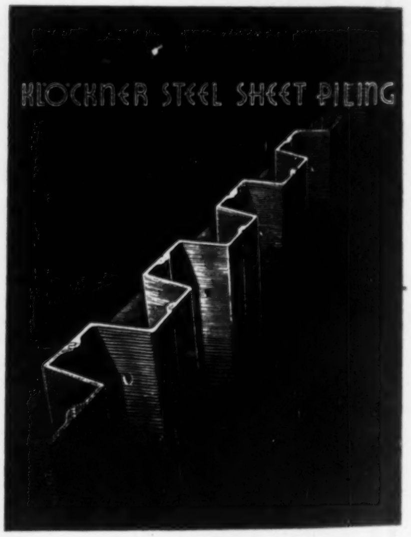
"'CATERPILLAR' Auto Patrols, for Year 'Round Service," is the title of a new 38-page catalog issued by Caterpillar Tractor Co. of Peoria, Illinois.

The catalog contains large reproductions of parts and assemblies, and action photographs depicting the year-around use of the machines in road construction, finishing and maintenance, oil mix, scarifying, and snow removal. The products described are the Diesel No. 11 and No. 10, and the gasoline-powered No. 11 and No. 10 Auto Patrols. All technical points of interest to the road machine user are fully discussed in an interesting and non-technical manner.

Copies may be obtained from the manufacturer or any "Caterpillar" distributor.

"Z" Piling

THE KLOECKNER Steel Corp., 75 West Street, New York, N.Y., has issued a comprehensive catalog of 24 pages on their Z-shaped steel sheet-piling sections. This catalog illustrates important American and foreign installations. Its technical pages give cross-section drawings of fifteen sections with the properties of each section and of the fabricated corners, tees, and crosses. Other drawings show adopted "Z" piling assemblies, braces, and tie rods.



Pages 16 and 17 will be of specific value to design engineers. These pages contain a diagram and formula for computing pressures in sheet-pile structures and a suggested practical method of calculating the strength of steel sheet-pile structures.

Copies of this booklet will be forwarded to responsible engineers on request.

STILL IN USE

LONDON, ENGLAND
Cast iron main 126 years old.

EHRENBREITSTEIN, GERMANY
Cast iron main 210 years old.

VERSAILLES, FRANCE
Cast iron mains 272 years old.

. . . and they average 203 years of service

You see above the unretouched photographs of three cast iron water mains, still functioning underground, after a term of service averaging 203 years. Engineers estimate the life of cast iron pipe at 100 years, which is, of course, conservative. No one knows the full span of the useful life of cast iron pipe. The first recorded installation, made 272 years ago in Versailles, France, is still in service. But all engineers know that cast iron pipe is the longest-lived, most economical material for underground mains. Cast iron is the standard material for water mains the world over. Its useful life is *more than a century* because it effectively resists rust. It is the one ferrous metal pipe for water or gas mains or sewer construction that will not disintegrate from rust. Available in diameters from 1¼ to 84 inches.

For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1013 Peoples Gas Bldg., Chicago, Illinois.

CAST IRON PIPE

METHODS OF EVALUATING BIDS NOW IN USE BY ENGINEERS RATE THE USEFUL LIFE OF CAST IRON PIPE AT 100 YEARS

TRADEMARK REG.

CURRENT PERIODICAL LITERATURE

Abstract of Articles on Civil Engineering Subjects from Magazines in This Country and in Foreign Lands

Selected items from the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file in The Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own file, from your local library, or direct from the publisher. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page, plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

Lift, Construction. Lift Span Erected by New Procedure. *Eng. News-Rec.*, vol. 116, no. 19, May 7, 1936, pp. 671–673. Erection of 310-ft trusses of lift span of Harlem River crossing of Triborough Bridge in New York by leaving off end panels of span until it had been raised clear of piers, and using temporary outrigger connections extending above level of top chords.

Maintenance and Repair, Toledo. Toledo Repairs Its Bridges. *Eng. News-Rec.*, vol. 116, no. 18, Apr. 30, 1936, pp. 634–636. Investigation prompted by collapse of Fassett St. Bridge reveals necessity of repairs on other bridges due to scoured foundations, corrosion on bascule, damage from vehicle collision, lack of expansion facility, and dangerous counterweight supports.

Railroad, Vibrations. Vibrations in Bridges, C. E. Inglis. *Structural Engr.*, vol. 8, no. 7, July 1935, pp. 294–301. Presentation of rational formulas for predicting vibrations in railway bridges; "deflection-frequency" curve for bridge of about 150-ft span; deflection-frequency curves modified by changes in value of spring friction; dynamic effects of train which may be following locomotive. Before Instn. Structural Engrs.

Steel, Welding. Foreign Countries Lead United States in Welded Bridges, LaM. Grover. *Eng. News-Rec.*, vol. 116, no. 20, May 14, 1936, pp. 703–709. Review of European accomplishments of last five years reveals many welded structures that have no counterparts as yet in American practice; special structural sections; swallowtail splices; typical details of all-welded Vierendeel truss bridges recently designed by Belgian highway authorities; flange sections adopted by German and Swedish engineers for welded girders; field fabrication.

Suspension, Cables, Comparison. Largest and Longest Bridge Cables Spun at New Record Rate, C. M. Jones. *Eng. News-Rec.*, vol. 116, no. 18, Apr. 30, 1936, pp. 617–622. New cable make-up on Golden Gate Bridge compared with George Washington Bridge cable; for first time number of wires per strand is varied, to secure more perfect circle through saddle; strands are also in vertical tiers instead of horizontal rows as formerly; stringing speed 60 per cent greater than on George Washington Bridge; progressive steps in increasing stringing speed; new footwalk design; strand lifting bands.

Suspension, Cables, Method. Cable Spinning on Bay Bridge, C. H. Purcell, C. E. Andrew, and G. B. Woodruff. *Eng. News-Rec.*, vol. 116, no. 19, May 7, 1936, pp. 656–661. Method of spinning cables for two suspension bridges comprising West Bay crossing of San Francisco–Oakland Bay Bridge; double-sheave spinning wheels place 128 tons of wire per day in mile-long trips between anchorages; footbridge cables later become suspenders; wire manufacturing technique; spinning machinery; cable compacting; tower saddles; saddle displacements during spinning; cable bands; suspender ropes.

Suspension, Golden Gate. Building World's Tallest Bridge Towers for Golden Gate Span. *Western Construction News*, vol. 10, no. 7, July 1935, pp. 181–185. Design problems and erection methods on 746-ft towers to carry 4,200-ft suspension span.

Suspension, Quebec. Methods of Constructing Suspension Bridge to Island of Orleans. *Eng. & Contract Rec.*, vol. 50, no. 31, July 31, 1935, pp. 615–622. Canada's longest suspension bridge over the St. Lawrence River near Quebec has suspended section of 2,370 ft and total length of 5,820 ft.

Suspension, San Francisco–Oakland Bay. Cable Spinning Procedure on Bay Bridge Reviewed West's First Use of This Construction Method, R. A. Tudor. *Western Construction News*, vol. 11, no. 1, Jan. 1936, pp. 12–16. Spinning of cables 29 in. in diameter for twin 2,310-ft spans containing 17,464 wires; 70,800 miles of wire, weighing 18,700 tons, required.

BUILDINGS

Steel, Design. Steel Frames for Buildings. *Mech. World*, vol. 99, no. 2576, May 15, 1936, pp. 493–494. Attention drawn to beam-to-stanchion connections by contradictory assumptions made in design; laboratory investigations, experimental framework, and measurements of frames of large buildings in course of erection have all been used in testing methods of stress analysis; important deductions from this work summarized.

CITY AND REGIONAL PLANNING

Great Britain. Town and Country Planning in Relation to Transport, T. Adams. *Instn. Mun. & County Engrs.—J.*, vol. 62, no. 14, Jan. 7, 1936, pp. 733–741, (discussion) 742–751. Failure of planning policies in securing coordinated treatment of related problems.

CONCRETE

Construction, Cold Weather, Protective Walls. Winter Concreting. *Eng. News-Rec.*, vol. 116, no. 20, May 14, 1936, p. 696. In construction, last winter, of new factory near Toronto, Ontario, for Continental Can Company of Canada, Ltd., workers were protected by studding and tarpaulin walls closed by roof on jacks, which lift it higher as building construction progresses upward.

Construction, Specifications. Building Regulations for Reinforced Concrete (A. C. I. 501–36T). *Am. Concrete Inst.—J.*, vol. 7, no. 4, Mar.–Apr. 1936, pp. 407–444. Code proposed by Committee 501 of American Concrete Institute; materials and tests; concrete quality and working stresses; mixing and placing concrete; forms and details of construction; design, general considerations; flexural computations; shear and diagonal tension; bond and anchorage; flat slabs, 2-way and 4-way systems with square or rectangular panels; reinforced concrete columns and walls.

Design. Stresses in Steel Reinforcement of Reinforced Concrete Structures, R. H. Evans. *Structural Engr.*, vol. 8, no. 9, Sept. 1935, pp. 354–369. Theoretical study of effect of change in assumed value of modular ratio on calculated stresses and deflections of reinforced concrete members; stress in tension reinforcement; strain and stress distribution; shear stress distribution; stress distribution in combined type of web reinforcement; stress and deflection of concrete floors. Bibliography. Before Instn. Structural Engrs.

Tanks. Water Tanks of Reinforced Concrete, A. L. Hewett. *Am. Water Works Assn.—J.*, vol. 28, no. 1, Jan. 1936, pp. 43–49. Principles of Hewett system of design of reinforced concrete water tank; circumferential reinforcement is left out and tank is hooped with steel on outside; steel is subsequently covered with concrete.

Walls. Strength and Stability of Monolithic Concrete Walls. *Eng. & Contract Rec.*, vol. 49, no. 41, Oct. 9, 1935, pp. 890–894. Results of test made by Engineering Experiment Station of University of Illinois on panels of single and double walls of various thicknesses, on ribbed walls, and on walls of dry tamped concrete and poured concrete.

DAMS

Concrete Gravity, Canal Zone. Concrete in Madden Dam, A. N. Beachamp. *Military Engr.*, vol. 28, no. 157, Jan.–Feb. 1936, pp. 31–36. Main features of concrete-gravity dam of 223 ft maximum height; design and tests of concrete mix; assembling materials; mixing concrete; placing.

Concrete Gravity, Equipment. Grand Coulée Dam Concreting Plant Is Notable for Design Efficiency, C. Thompson. *Western Construction News*, vol. 11, no. 2, Feb. 1936, pp. 31–36. Bins, batching equipment, and four 4-yd mixers arranged in compact tower structure on west abutment; capacity of 6,000 cu yd per day; placing trestles and methods described.

Concrete Gravity, Gravel Plant. Preparing Millions of Yards of Aggregate for Grand Coulée Dam. *Western Construction News*, vol. 10, no. 11, Nov. 1935, pp. 310–315. Equipment and layout of gravel plant designed to meet rigid specifications for mass concrete.

Concrete Gravity, Washington. Grand Coulee Dam—World's Greatest Conveyorized Construction Project. *Boston Soc. Civ. Engrs.*, vol. 23, no. 2, Apr. 1936, pp. 89–108. Symposium of two papers: Excavation and Conveyor System, S. M. Mercier; Grand Coulee Aggregate Plant, G. F. Dodge.

Earth. Small Earth Dams, W. A. Hardenbergh. *Pub. Works*, vol. 66, no. 12, Dec. 1935, pp. 28–29; vol. 67, nos. 1, 2, and 3, Jan. 1936, pp. 15–16; Feb., pp. 17–18; and Mar., pp. 25–26. December: Factors in design and construction. January: Spillway capacity and runoff estimates. February: Construction materials. March: Construction procedure.

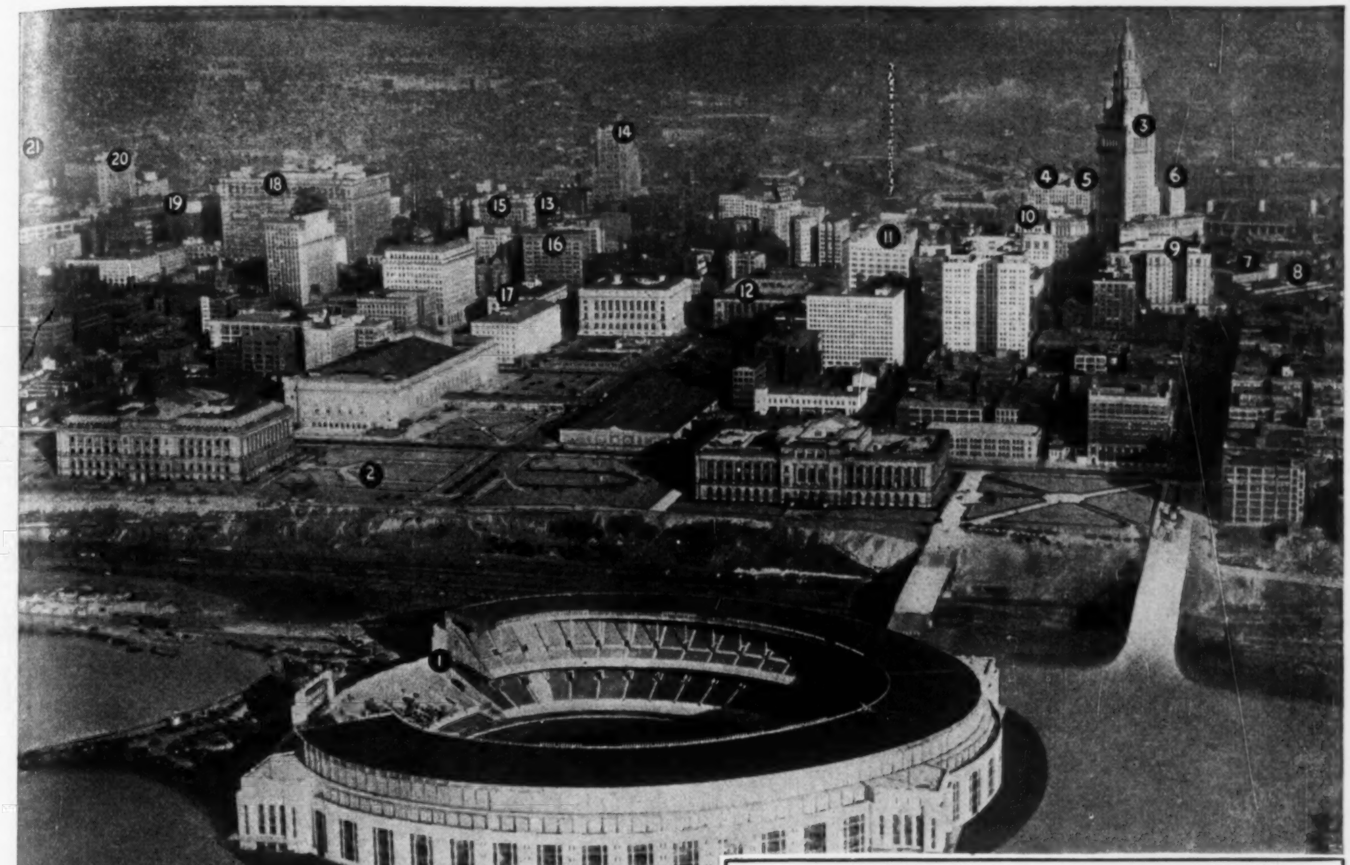
Earth, Design. Design of Earth-Fill Dams, W. W. Wyckoff. *Am. Water Works Assn.—J.*, vol. 28, no. 1, Jan. 1936, pp. 127–133. Principles of design of earth-fill dams with special reference to rate of percolation; stability of foundation; cutoff walls; face protection; spillway; outlet works.

Earth, Failure. Elk City Earth Dam Fails During Deluge. *Eng. News-Rec.*, vol. 116, no. 19, May 7, 1936, p. 678. Long, low embankment in Oklahoma washed out at midpoint as spillway proves inadequate to pass cloudburst storm causing runoff of nearly 1,000 cu ft per sec per sq mile.

Earth, Massachusetts. Design and Progress on Construction of Dams for Quabbin Reservoir, S. M. Dore. *Boston Soc. Civ. Engrs.—J.*, vol. 22, no. 3, July 1935, pp. 151–177. Exploration of sites and construction of main earth dam, 4,000,000 cu yd in volume, and earth dike 2,500,000 cu yd in volume, for Quabbin Reservoir of Massachusetts Metropolitan District Water Supply Commission; cutoff investigations; exploratory caissons; stream control tunnel at Main Dam; spillway; comparative statistics of large earth dams with fine earth cores in United States. Bibliography.

Earth, Montana. Moving Mountains of Earth Fill at Fort Peck Dam Project, D. A. D. Ogden. *Western Construction News*, vol. 10, no. 8, Aug. 1935, pp. 228–233. Dredging and pumping equipment and methods of operation for moving 3,000,000 cu yd of fill per month.

Earth, Soil Mechanics. Practical Soil Mechanics at Muskingum—IV, T. T. Knappen and R. R. Philippe. *Eng. News-Rec.*, vol. 116, no. 19, May 7, 1936, pp. 666–669. Selection and control of embankment materials; embankment consolidation; determining moisture content; laboratory plan and costs.



The Cleveland that ABC built

CLEVELAND, center of attraction with its Great Lakes Centennial Exposition which aptly has chosen "The Romance of Iron and Steel" as its basic theme, justly may attribute its greatness to the development of steel—for steel has made possible its diversified industries, busy transportation arteries and stately buildings.

American Bridge Company's share in Cleveland's growth is evidenced by some 348,000,000 pounds of fabricated steel which constitute the framework of 30 prominent downtown structures—and an additional 100,000,000 pounds which enter into the construction of many of Cleveland's industrial plants.

In this fact of being largely built by ABC, Cleveland is typical of most great American cities.

Structures shown in photograph, wholly or in large part done by American Bridge Company

1—Lakefront Stadium
2—Underground Exhibition Hall
3—Terminal Tower
4—Republic Bldg.
5—Builders' Exchange Bldg.
6—Midland Bldg.
7—Union Station
8—Huron Rd. Viaduct
9—Hotel Cleveland
10—Higbee Bldg.
11—May Bldg.
12—Federal Bldg.
13—Wm. Taylor & Son Bldg.
14—Ohio Bell Telephone Bldg.
15—Guardian Bldg.
16—Leader Bldg.
17—Plain Dealer Bldg.
18—Union Trust Bldg.
19—Statler Hotel
20—Hanna Bldg.
21—Keith Bldg.

NOT IN PHOTOGRAPH

22—Winton Hotel
23—Masonic Bldg. Assn., Hall & Gymnasium
24—Citizens Savings & Trust & Union Commerce National Bank Bldg.
25—Cleveland Electric Illuminating Co., 20th St., Heating Plant
26—Woolworth Bldg.
27—Cleveland Electric Illuminating Co., Bolivar Rd. Substation
28—Halle Bros. Bldg.
29—Cuyahoga Viaduct
30—Post Office Bldg. Substructure

In this Terminal Tower Group, these structures were done by American Bridge Company. This photograph does not show the recent post office building erected in the foreground, steel substructure for which was ABC fabricated.

AMERICAN BRIDGE COMPANY

General Offices: Frick Building, Pittsburgh, Pa.

Baltimore · Boston · Chicago · Cincinnati · Cleveland · Denver · Detroit
Duluth · Minneapolis · New York · Philadelphia · St. Louis

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

Earth, Utah. Pine View Dam Preliminaries Include Variety of Features. *Western Construction News*, vol. 10, no. 9, Sept. 1935, pp. 243–245. Preparatory works discussed are pipeline, tunnel, and sheet-pile cutoff operations.

Earth, Virginia. Soil Technology in Earth Dam Construction as Employed in Back Creek Dam, C. A. Hogentogler, Jr. *Pub. Works*, vol. 66, nos. 5 and 6, May 1935, pp. 28 and 30, and June, pp. 15–18. May: Design features; soil examinations; soil profiles in borrow pit; selection of material. June: Studies in compaction; control during construction; construction procedure.

Flood Damage. Navigation Dams near Pittsburgh Damaged by Floods. *Eng. News-Rec.*, vol 116, no. 18, Apr. 30, 1936, pp. 630–631. Description of damage done to two navigation dams on Ohio and Allegheny rivers near Pittsburgh by destructive flood of March 1936.

Foundations. Measuring Bed Rock Action Under Tygart Dam, J. E. Deignan. *Eng. News-Rec.*, vol. 116, no. 21, May 21, 1936, p. 731. Description of elastic-wire strain meters buried in special test holes under Tygart River concrete-gravity dam, 232 ft high, to register deformations in foundation shale for remote reading.

Government Supervision. Accomplishments in State Supervision of Dams, G. W. Hawley. *Am. Water Works Assn.—J.*, vol. 27, no. 11, Nov. 1935, pp. 1492–1503. Deputy state engineer in charge of dams reviews activities and accomplishments of state supervision of dams in California.

FLOOD CONTROL

China. Kinshui Reclamation Project, G. C. Stroebe. *Assn. Chinese & Am. Engrs.—J.*, vol. 17, nos. 1 and 2, Jan.-Feb. 1936, pp. 1–21, and Mar.-Apr., pp. 88–98, 7 supp. sheets. Description of large flood protection and land reclamation project, involving construction of earth dam across Kinshui River, 100 m long and about 20 m high, also large tunnels, canals, and dikes; 900,000 mou of land will thus be reclaimed; data on evaporation from plants and lakes. (In English.)

Levees, Maintenance and Repair. Runaway River Controlled, O. J. Todd. *Eng. News-Rec.*, vol. 116, no. 21, May 21, 1936, pp. 735–738. Primitive methods used in repairing breach of great dike on Yellow River, China; only manual labor used, keeping 25,000 men busy; total cost $800,000.

Levees, Subsidence. Muck Subsidence Under Okeechobee Levee, J. W. Bruce and I. M. Pafford. *Military Engr.*, vol. 27, no. 156, Nov.-Dec. 1935, pp. 457–460. Description of Lake Okeechobee levee in Florida; measuring subsidence; subsidence during loading; relation between settlement and height of fill; ultimate subsidence; practical application; firmness of substrata; shrinkage of levee.

New York. Emergency Work of Division of Sanitation During New York State Flood, A. F. Dappert. *Am. Water Works Assn.—J.*, vol. 27, no. 12, Dec. 1935, pp. 1647–1669; see also *New England Water Works Assn.—J.*, vol. 49, no. 4, Dec. 1935, pp. 376–394. Meteorological conditions; damages to water supply; field organization; control of private water supplies; general emergency work; cooperating agencies; help from areas outside; examples of difficulties; lessons.

Portsmouth, Ohio. Portsmouth River Wall Again Protects City, C. S. Stevenson and A. E. Wall. *Eng. News-Rec.*, vol. 116, no. 19, May 7, 1936, pp. 669–671. Description of concrete wall, 15,300 ft long, built in 1916 and in 1929, together with system of embankments, which again saved Portsmouth from flood of March 1936.

FOUNDATIONS

Design. Shallow Foundations, W. S. Gray. *Concrete & Constr. Eng*, vol. 31, no. 5, May 1936, pp. 280–298. Principles of design of shallow reinforced-concrete foundations; experimental values of distribution of stresses; foundations on clay; modulus of soil reaction; derivation of equations; special cases of foundations; effect of variation in moment of inertia of slab; numerical examples.

Earth Pressure. Fundamental Fallacy in Earth Pressure Computations, K. Terzaghi. *Boston Soc. Civ. Engrs.—J.*, vol. 23, no. 2, Apr. 1936, pp. 71–88; see also abstract in *Eng. News-Rec.*, vol. 116, no. 20, May 14, 1936, pp. 690–693. Paper leading to conclusions that pressure changes are caused by elastic movements within sand fill supported by timbering, and shearing stresses due to these movements relieve pressure as timbering deflects slightly; strain effect of local expansion; arching above yielding trapdoors; arching behind lateral supports; lateral pressure of cohesive soils. Bibliography.

Piles, Concrete-Steel. Concrete-filled Steel Tube Piles, A. M. Bouillon. *Military Engr.*, vol. 27, no. 156, Nov.-Dec. 1935, pp. 26–29. Review of American practice; conditions affecting use; value as friction piles; driving to firm stratum; precautions in placing concrete; advantages and limitations of concreted tube piles.

HYDRAULIC ENGINEERING

Culverts, Discharge. Discharge of Rectangular Culverts, R. C. Robin. *Instn. Engrs. Australia—J.*, vol. 8, no. 3, Mar. 1936, pp. 83–93. Report on model tests carried out in Hydraulic Laboratory of University of Adelaide; theoretical formula of discharge through submerged culverts under small head, based on Bernoullis equation.

HYDROLOGY, METEOROLOGY, AND SEISMOGRAPHY

Rain and Rainfall, New York. Rainfall and Stream Flow Conditions During Floods in Central and Southern New York, A. W. Harrington. *Am. Water Works Assn.—J.*, vol. 28, no. 1, Jan. 1936, pp. 1–5. Data on rainfall and runoff due to series of thunderstorms of July 7 and July 8, 1935, centered in area of 7,000 sq miles in central and southern New York; flood flows; inadequate gaging stations.

Runoff. Rainfall Intensities, E. O. Baxter. *Instn. Mun. & County Engrs.—J.*, vol 62, no. 10, Nov. 5, 1935, pp. 529–549. Development of method of calculation to eliminate possible errors in runoff calculation; coordination of rainfall intensity duration curves.

Runoff, Forecasting. Snow Surveys Predict Runoff, G. A. Hathaway. *Eng. News-Rec.*, vol. 116, no. 21, May 21, 1936, pp 728–730. Records of stream discharges in upper Missouri River valley, which were accurately forecast last year from studies of condition of snow fields, to be continued as guide to future operation of Fort Peck Reservoir; comparison of predicted and actual runoff; establishing normals.

Watersheds, Erosion. Correlation of Erosion with Land Use and Slope in Norris Dam Watershed, A. R. Spillers. *J. Forestry*, vol. 34, no. 5, May 1936, pp. 492–497. Results of erosion survey at Tennessee Valley Authority development; effect of land use on erosion; effect of slope on erosion; recommendations.

IRRIGATION

Canals, California. Desilting Works for All-American Canal, C. P. Vetter. *Western Construction News* vol. 10, no. 10, Oct. 1935, pp. 288–290. Plant designed to remove 70,000 tons of silt per 24 hr from Colorado River water for Imperial Valley.

United States. Watering Great Plains, G. S. Knapp. *Eng. News-Rec.*, vol. 116, no. 19, May 7, 1936, pp. 664–665. Need of intensive engineering study and of more satisfactory water-right laws for development of irrigation in semi-arid area of Great Plains comprising 400,000 sq miles from 98th meridian westward to 5,000-ft contour along foothills of Rocky Mountains, and from Canadian boundary southward to thirty-second degree of latitude.

LAND RECLAMATION AND DRAINAGE

Soils, Erosion. Design and Construction of Sodded Terrace Outlet Channels, H. Marson. *Agric. Eng.*, vol. 16, no. 8, Aug. 1935, pp. 321–322, and 330. Theoretical depth of water and bed width of channel for various slopes and quantities of runoff at increments of 10 cu ft per sec; calculations based on Manning formula for flow of water in open channels.

Soils, Erosion, China. Soil Erosion and River Regulation with Special Reference to Yellow River, S. Eliassen. *Assn. Chinese & Am. Engrs.—J.*, vol. 17, no. 1, Jan.-Feb. 1936, pp. 22–38, 4 supp. sheets. General aspects of problem; possibilities of erosion control; gully erosion; surface erosion; extent of area to be treated; effect of control of soil erosion on flood flow of Yellow River. (In English.)

Soils, Erosion, Exhibits. Visualizing Soil Erosion Control, M. F. Thurmond. *Agric. Eng.*, vol. 16, no. 5, May 1936, pp. 191–192. Factors to be considered in planning exhibits; methods used in preparing exhibit to show method of erosion control being advocated by U. S. Soil Erosion Service.

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Soils, Erosion, Terraces. Selection of Channel Grade for Terraces, H. S. Riesol. *Agric. Eng.*, vol. 19, no. 8, Aug. 1935 pp. 308–312. Results of study to determine most satisfactory design for terrace system by U. S. Soil Erosion Experiment Station in Red Plains Region of Oklahoma, Kansas, and Texas; effect of channel grade on runoff characteristics, moisture conservation, soil loss, crop yields, and tillage.

MATERIALS TESTING

Concrete, Bond. Bond Resistance of High Strength and Vibrated Concrete, W. F. Cassie. *Structural Engr.*, vol. 8, no. 8, Aug. 1935, pp. 322–336. Investigation carried out by author at University of Illinois, under direction of F. E. Richart; nature and testing of bond resistance; results of pull-out tests; increase in bond resistance caused by vibration; beam tests. Before Instn. Structural Engrs.

Soils. Improved Soil Testing Methods, G. Gilboy. *Eng. News-Rec.*, vol. 116, no. 21, May 21, 1936, pp. 732–734. Description of new instruments for consolidation, shear, and permeability tests contributed to soil investigations on Muskingum project. Bibliography.

PORTS AND MARITIME STRUCTURES

Concrete. Pre-Cast Concrete in Canal Zone Wharf, P. Andersen. *Military Engr.*, vol. 28, no. 157, Jan.-Feb. 1936, pp. 15–16. Description of new wharves at Gamboa, Canal Zone, built for Dredging Division of Panama Canal, including main wharf 400 ft long and shorter approach wharf 150 ft long, made up of pre-cast concrete piles supporting arch rings of pre-cast concrete.

Jetties. Rebuilding Long Jetty for Columbia River. *Western Construction News*, vol 10, no. 9, Sept. 1935, pp. 246–249. Construction operations required to replace new rock top on existing enrockment 3$^3/_4$ miles long at mouth of Columbia River.

Port Terminals, New York City. Railroads' Marine Operations in New York Harbor, J. H. Lofland. *Mar. Eng. & Shipg. Rev.*, vol. 41, no. 5, May 1936, pp. 258–260. Particulars of operations, which represent investment of $50,000,000 and employ 3,400 men; interchange service and use of car floats; lighterage service; ferry operation, maintenance, etc., discussed. Before New York Railroad Club.

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ROADS AND STREETS

Cold Weather Construction. Cold-Weather Low-Cost Road Construction Using Tar, A. R. Taylor. *Pub. Works*, vol. 66, no. 1, Jan. 1935, pp. 23–24. Precaution to be taken in method of construction, and in selection of tar.

Cotton Mats. Cotton Roads in United States, N. Mackinnon. *Roads & Road Construction*, vol. 14, no. 160, Apr. 1, 1936, pp. 104–105. Review of recent developments and experiments, including experiments on bridge floors.

Drainage. Subgrade Drainage for Highways. *Pub. Works*, vol. 67, no. 6, June 1936, pp. 16–18. Data on surface or pipe-enclosed ditches; french drains; designing subdrain; size of subdrain pipe; slope of pipe; outlet of pipe; openings in pipe; trench and backfill; stabilization of fills.

Highway Systems, Spain. La Red de Carreteras Espanolas Durante el Siglo XX, D. Diaz-Ambrona. *Hormigon y Acero*, no. 19, Nov. 1935, pp. 476–486. Spanish highway systems during twentieth century; classification by rank, width, and type; progress in construction, as direct result of growth in popularity of automobiles; comparison with railroad construction; relation of construction costs to improvement and maintenance costs; advantages of low wage scale.

Materials, Bituminous. Adhesion in Relation to Bituminous Road Materials, A. R. Lee. *Roads & Road Construction*, vol. 14, no. 159, Mar. 2, 1936, pp. 82–83. Jar test; plate test for detecting displacement of binder by water; use of wet stones for surface dressings; oil treatment of stones; mechanical adhesion in road construction. Before Soc. Chem. Industry.

Railroad Crossings, Signals and Signaling. 500,000 Crossing Protection Program of Illinois, T. J. Weber. *Ry. Signaling*, vol. 29, no. 3, Mar. 1936, pp. 130–135. Federal funds used effectively to provide automatic signals at 264 crossings and reflector crossbuck signs at 420 crossings.

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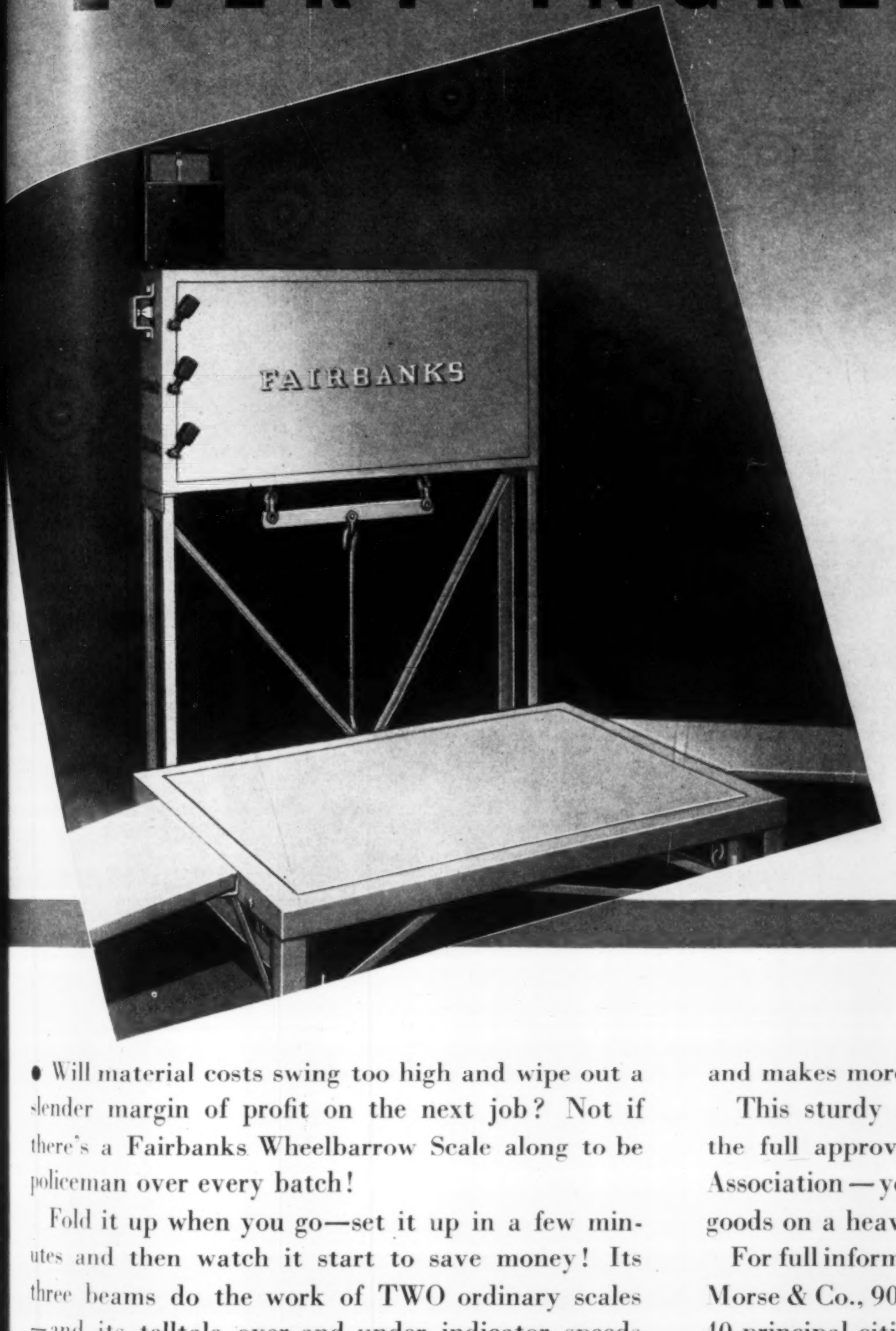

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SALTS STABILIZATION. No Hard and Fase Rules for Building Stabilized Roads, J. A. Knight. *Eng. & Contract Rec.*, vol. 50, no. 8, Feb. 10, 1936, pp. 117–118, and 120–121. Economy of calcium chloride stabilized road is due to fact that specifications are variable and wide variety of materials can be used.

SLIPPERINESS. Slipperiness of Roads, R. M. J. Saal. *Quarry & Roadmaking*, vol. 41, no. 473, Jan. 1936, pp. 3–6. Results of measurements of coefficient of friction by various investigators; apparatus developed by author for testing slipperiness.

STABILIZATION. Road Construction by Soil Stabilization Methods, C. A. Hogentogler and C. M. Johnston. *Eng. & Contract Rec.*, vol. 49, no. 38, Sept. 18, 1935, pp. 793–797. Development and application of soil control as means of making low-cost roads.

SEWERAGE AND SEWAGE DISPOSAL

ACTIVATED SLUDGE. Carbon Dioxide Production in Mixtures of Sewage and Activated Sludge, H. Heukelekian. *Sewage Works J.*, vol. 8, no. 2, Mar. 1936, pp. 210–222. Results of experimental study made at Division of Water and Sewage Research, New Brunswick, N.J., for evaluating rate of oxidation of sewage and sludges in aerobic systems by use of index of CO_2 production; methods; comparison of rate of oxidation by B.O.D. and CO_2 production methods. Bibliography.

CHEMICAL PROCESS, EXPERIMENTS. Chemical Sewage Coagulation, W. Rudolfs and H. W. Gehm. I—Effect of pH. II—Relation Between Turbidity, Suspended Solids, and B.O.D. *Sewage Works J.*, vol. 8, no. 2, Mar. 1936, pp. 195–209. Results of experimental study of effect of ferric chloride with varying values of hydrogen-ion concentration on removal of suspended solids in different sewages; effect of varying settleable solids.

CHEMICAL PROCESS, MECHANICAL METHODS. Mechanical-Chemical Methods of Sewage Treatment, H. C. H. Shenton. *Can. Engr.*, vol. 69, no. 2, July 9, 1935, pp. 9–12. Latest experiments in which full advantage has been taken of new mechanical appliances and chemical treatment. Before Inst. Sanitary Engrs.

NEW YORK. Policies and Progress in Sewage Treatment in New York State, E. Devendorf. *Sewage Works J.*, vol. 8, no. 2, Mar. 1936, pp. 272–281. Review of sewage-works construction in New York state, financed by federal authorities. Before New York State Sewage Works Assn.

PLANTS, DESIGN. Simplifying Sewage-Treatment Calculations, J. R. McComas. *Eng. News-Rec.*, vol. 116, no. 14, Apr. 2, 1936, p. 501. Determination of ability of stream to absorb by dilution sewage emanating from known population.

PLANTS, MINNESOTA. Seven Years' Study Back of Twin Cities' Sewage-Disposal Plan. *Eng. News-Rec.*, vol. 116, no. 15, Apr. 9, 1936, pp. 527–530. Selection and design of sewage-disposal facilities for Minneapolis–St. Paul district, including treatment plant with capacity of 134 mgd and 53-mile sewer extension; design modified to take advantage of improved methods of sewage treatment; rates of re-aeration; relationship of treatment-plant effluent, river discharge, and temperature to maintain minimum of 2 ppm of dissolved oxygen in Hastings pool; flow diagram of parallel operation.

PLANTS, NEW BRUNSWICK, N.J. Chemical Precipitation to Be Used at New Brunswick Sewage Plant. *Eng. News-Rec.*, vol. 116, no. 13, Mar. 26, 1936, pp. 448 and 449. Construction of additional sewerage facilities and sewage-disposal plant with capacity of 9 mgd, employing chemical precipitation, separate sludge digestion, and vacuum filtration at New Brunswick, N.J.; sedimentation aided by chemical coagulation expected to give 70 per cent reduction of suspended solids; sludge digested and dewatered on vacuum filters.

PLANTS, OPERATION. Developments in Operation of Sewage-Treatment Plants. *Eng. News-Rec.*, vol. 116, no. 9, Feb. 27, 1936, pp. 321–322. Review of experiences in operation of sewage-treatment plants in Illinois; screens; grit chambers; primary sedimentation; separate sludge digestion; sludge drying; secondary sedimentation; sprinkling filters; activated sludge; plant records. Before Ill. Soc. Engrs.

PLANTS, OPERATION. Operation of Norristown Sewage Treatment Works, F. B. Altemus. *Sewage Works J.*, vol. 8, no. 2, Mar. 1936, pp. 334–337. Operating experience of Borough of Norristown, Pa., sedimentation plant with separate sludge digestion; management and personnel; operation of bar screen, grit chamber, suction well, motors and pumps, auxiliary power, settling tanks, digestion tanks, and sand beds; records.

REFUSE DISPOSAL, DIGESTION. Garbage Disposal Into Sewers, G. E. Griffin. *Pub. Works*, vol. 67, no. 3, Mar. 1936, pp. 12 and 13. Excerpts from report to Board of Selectmen of Greenwich, Conn.; plant experiences at Lebanon, Pa., University of Illinois, Baltimore, St. Louis, Indianapolis, Durham, N.C., Kansas City, and Grand Rapids, Mich.

RESEARCH. Research in Sewage Chemistry, Sewage Treatment, and Stream Pollution, H. A. Faber, W. S. Mahlie, W. Rudolfs, and E. B. Phelps. *Sewage Works J.*, vol. 8, no. 2, Mar. 1936, pp. 161–194. Critical review of world's technical literature of 1935, dealing with sewage chemistry and biology, activated sludge, sludge handling and disposal, chemical treatment, mechanical equipment, filtration, chlorination, and allied processes, and with stream pollution. Bibliography.

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SEWERS, SUBAQUEOUS. Twin 36-In. Wood-Stave Pipes Moved Bodily Across Channel. *Eng. News-Rec.*, vol. 116, no. 13, Mar. 26, 1936, pp. 447–448. Method of laying wood-stave sewers under channel crossing, 1,250-ft long, 43 ft maximum depth, at Salmon Bay near Seattle, Wash.; assembled in cradle on shore, pipe was advanced into water as built; exact buoyancy calculations and variable weight of wood necessitated careful balancing; details of wood-stave pipe assembly.

SLUDGE. Sewage-Sludge Incinerator Introduced at Calumet, W. A. Dundas. *Eng. News-Rec.*, vol. 116, no. 4, Jan. 23, 1936, pp. 116–119. Drying and incineration of daily load of 40 dry tons of putrescible solids from Calumet activated-sludge plant of Sanitary District of Chicago; waste vapors are passed through 2,500 F furnace heat for deodorization and then go to dust precipitator; conditioning equipment includes mixing flume, where ferric chloride is added, and two agitating tanks provided with mechanically operated paddles; ash disposal.

SLUDGE DEWATERING. Sludge Dewatering on Drying Beds, C. H. Young. *Sewage Works J.*, vol. 8, no. 2, Mar. 1936, pp. 331–334. Data on rate of drying for different sludges; rate of sludge tests showing drying on open and covered beds based upon percentage of total water removed which left sludge at end of given time; results on operation of open and glass-covered sludge beds. Before Pa. Sewage Works Assn.

STRUCTURAL ENGINEERING

ARCHES, CONCRETE. Temperatures in Concrete Arches, C. R. Whyte. *Eng. News-Rec.*, vol. 116, no. 20, May 14, 1936, pp. 693–695. Temperature graphs of ribs of concrete bridges in Washington, D.C.; key pours in ribs of Calvert and P St. bridges delayed from 7 to 10 days while concrete cooled from maximum temperatures ranging from 90 to 121 F.

ARCHES, MASONRY. Calculation of Arches for Road and Rail Traffic Act, P. H. Johnson. *Structural Engr.*, vol. 8, no. 9, Sept. 1935, pp. 369–376. Design of masonry and concrete arches to satisfy requirements of recent British specifications; numerical examples.

BEAMS, CONCRETE. Experiments on Stress Distribution in Reinforced Concrete Beams, R. H. Evans. *Structural Engr.*, vol. 14 (new series), no. 3, Mar. 1936, pp. 118–130. Results of many years of tests made in civil engineering laboratory of University of Leeds; strain and stress distribution in doubly reinforced concrete beams; strain distribution in beams in which bond of tension reinforcement has been eliminated, so that reinforcement behaves as tie rod; full-sized structural tests. Before Instn. Structural Engrs.

COLUMNS, CONCRETE, DESIGN. Bending and Direct Stress in Concrete Columns, F. C. Whitney. *Eng. News-Rec.*, vol. 116, no. 14, Apr. 2, 1936, p. 500. Construction of chart for computing bending and direct stress in square banded columns reinforced on all four faces; numerical example.

COLUMNS, STEEL, CONCRETE INCASED. Some Tests of Steel Columns Incased in Concrete, A. H. Stang, H. L. Whittemore, and D. E. Parsons. *U. S. Bur. Standards—J. Research*, vol 16, no. 3 (RP873) Mar. 1936, pp. 265–287, 6 supp. plates. Results of tests, carried out by National Bureau of Standards in cooperation with bridge department of Port of New York Authority, on four carbon-steel columns incased in reinforced concrete to determine their strength and stiffness.

FLOORS, CONCRETE. Eisenbetondecken im Luftschutzbau, Ruehe. *Zement*, vol. 24, no. 49, Dec. 5, 1935, pp. 786–788. Reinforced concrete floors in anti-aircraft shelters; example given of cellar construction in group of apartment houses in Breslau, Germany, with special reference to roof construction.

TRUSSES, DESIGN. Design of Statically Indeterminate Trusses, A. Haertlein. *Boston Soc. Civ. Engrs.—J.*, vol. 23, no. 2, Apr. 1936, pp. 57–70. Outline of method of obtaining preliminary design which will approximate final design without introducing assumptions now generally made.

WALLS, CONCRETE. Wandbildung im Wohnungs- und Siedlungsbau unter Verwendung von Schwerbeton, Groebl. *Zement*, vol. 24, no. 39, Sept. 26, 1935, pp. 613–616. Wall construction in apartment and settlement houses with use of heavy concrete; details of system employing brick with insulating space, which makes it possible to use so-called heavy concrete (made of gravel or sand with broken stone) in place of lightweight concrete.

WIND BRACING. Calcul du contreventement dans une construction métallique ou en béton armé, F. Biron. *Travaux*, vol. 19, no. 31, July 1935, pp. 266–271. Review of European and American methods of design of wind bracing for metallic and reinforced concrete structures.

TUNNELS

CONSTRUCTION. Mining Technique Used in Driving Yerba Buena Tunnel, G. J. Young. *Eng. & Min. J.*, vol. 137, no. 3, Mar. 1936, pp. 140–141. Notes on practice in driving one of links in San Francisco–Oakland Bay Bridge project; clear width at spring line is 65.5 ft and maximum height nearly 50 ft,

RAILROAD, DOORS. Railway Tunnel with Doors. *Engineer*, vol. 161, no. 4189, Apr. 24, 1936, p. 438. Tunnel at Brockville, Ontario, claimed to be only one in world with doors; they are of stout wooden construction, at both ends of tunnel, and are opened and closed twice daily during severe winter weather; dual purpose served—protection of fabric and prevention of road bed from heaving.

VEHICULAR, CALIFORNIA. Yerba Buena Tunnel, C. H. Purcell, C. E. Andrew, and G. B. Woodruff. *Eng. News-Rec.*, vol. 116, no. 4, Jan. 23, 1936, pp. 111–114. Design and construction of double-deck, 6-lane, vehicular tunnel, 540 ft long; 65.5 ft maximum width, forming part of San Francisco–Oakland Bay Bridge project; tunnel driven under protection of 16-in. steel beam roof supports and lined before core was excavated.

VEHICULAR, VENTILATION. Midtown Hudson Tunnel. New Jersey Ventilation Building. *Port New York Authority—Contract MHT-11*, Mar. 1936, 212 pp. Information of bidders on and specifications of 7-story ventilation building on New Jersey side, about 140 ft high with foundation down to 60 ft below ground surface.

WATER SUPPLY. Novel High Pressure Grouting Methods Seal Fissures in Wet Tunnel, C. R. Rankin. *Eng. News-Rec.*, vol. 116, no. 19, May 7, 1936, pp. 661–663. Use of full-face timber bulkheads; grouting successive zones at increasing pressures in sealing of badly broken formation in San Jacinto tunnel on Colorado River aqueduct; advance grouting; rings of air-applied concrete; grouting behind bulkheads; design pressure of 250 lb.

WATER SUPPLY, CALIFORNIA. Coast Range Tunnel of Hetch Hetchy Aqueduct, L. W. Stocker. *Am. Water Works Assn.—J.*, vol. 27, no. 12, Dec. 1935, pp. 1670–1683. History of Hetch Hetchy water supply system for San Francisco; design and construction of Coast Range Tunnel 10.5 ft in diameter, consisting of two sections—one 25.2 miles long, and the other 3.44 miles long; grades; lining; pipe-line connections at portals; shafts; construction difficulties.

WATER SUPPLY, CONSTRUCTION. Tunnel Progress at Parker Dam Aided by Large Drill Jumbo. *Eng. News-Rec.*, vol. 116, no. 7, Feb. 13, 1936, pp. 249–250. Jumbo with working platforms at three levels and mountings for 19 drills facilitating progress in twin diversion tunnels of

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Water Supply, Testing. Model and Full-Size Surge Tests on Large Branched Tunnel System of Detroit Water Supply, A. C. Michael. *Am. Water Works Assn.—J.*, vol. 28, no. 3, Mar. 1936, pp. 295–317. Report on tests of effects of surges due to starting and stopping of pumps in new Springwells Low Lift Pumping Plant, on flow in tunnel, over 87,000 ft long, varying in diameter from 10 to 15.5 ft.

WATER PIPE LINES

Aqueducts, Colorado River. Solving Problem of Concrete Curing on Colorado River Aqueduct, L. H. Tuthill. *Western Construction News*, vol. 10, no. 8, Aug. 1935, pp. 220–223. Tests over four-year period resulted in decision to use coal-tar pitch cutback for concrete curing under severe desert conditions; value of white coating over coal tar demonstrated in lowering temperature in concrete exposed to sun.

Cross Connections. Sicherungen der Trinkwasserleitungen gegen Rueckritt von Warm- und Abwasser, F. Weckwerth. *Gas- u. Wasserfach*, vol. 78, no. 36, Sept. 7, 1935, pp. 687–690. (discussion) 691–692. German devices and arrangements for protecting water connections in houses against pollution from cross connections.

WATER RESOURCES

Underground, New Jersey. Quantitative Investigations of New Jersey Ground-Waters, H. C. Barksdale. *Water Works Eng.*, vol. 89, no. 3, Feb. 5, 1936, pp. 150 and 153. Study of six typical areas in New Jersey showing that overdrafting of wells threatened salt intrusion in Atlantic City area; safe yield of water-bearing sands. Before Am. Water Works Assn.

United States. Water-Resources Study Begun on Nation-Wide Scale. *Eng. News-Rec.*, vol. 116, no. 21, May 21, 1936, pp. 726–727. Outline of detailed survey of utilization and planning of water resources in major drainage basins of United States, carried out in cooperation with state and regional planning boards, by Water Resources Committee of National Resources Board; objectives of survey; ultimate aims.

WATER TREATMENT

New Orleans, La. Purification Methods at New Orleans, C. C. Friedrichs, Jr. *Am. Water Works Assn.—J.*, vol. 28, no. 4, Apr. 1936, pp. 537–541. History of purification of Mississippi River water at New Orleans since 1909; analysis of raw Mississippi River water; present chemical treatment practice in New Orleans.

Plankton. Plankton Control in Morris Reservoir, C. W. Sopp. *Am. Water Works Assn.—J.*, vol. 28, no. 4, Apr. 1936, pp. 447–457; see also *Water Works Eng.*, vol. 89, no. 4, Feb. 19, 1936, pp. 189–192. Study of plankton organisms in storage reservoir (245 ft maximum depth) of water department of Pasadena, Calif.; growth of diatomaceae and their death after copper sulfate treatment; sampling; control limits and methods; occurrence of microorganisms; seasonal variation of temperature gradient in Morris Reservoir.

Reservoirs, Weed Control. Weed Growths in Reservoirs and Open Canals, G. E. Arnold. *Am. Water Works Assn.—J.*, vol. 27, no. 12, Dec. 1935, pp. 1684–1693. Review of experience of Water Department of San Francisco; determination of taste-producing qualities of weeds growing in water; canal growths; weed control with copper sulfate.

Taste and Odor Removal, Experiments. Prechlorination with Ammonia in Turbid Water Supply, G. F. Gilkinson. *Water Works Eng.*, vol. 89, no. 2, Jan. 22, 1936, pp. 87 and 102. Report on successful experimentation at Kansas City (Mo.), plant solving problem of tastes and odors arising from algae; chemical treatment procedure; retention periods and load efficiencies; remarkable results in bacterial efficiency. Before Missouri Water and Sewerage Conference.

United States. Recent Progress in Supplying Less Corrosive Soft Water, M. Pirnie. *New England Water Works Assn.—J.*, vol. 49, no. 4, Dec. 1935, pp. 419–427. Review of progress achieved in water purification at Providence, R.I.; Utica, N.Y.; Indianapolis, Ind.; and Palm Beach, Fla.

WATER WORKS ENGINEERING

Denver, Colorado. Denver Building Trans-Mountain System to Supplement Present Water Supply, E. H. Schneider. *Western Construction News*, vol. 10, no. 12, Dec. 1935, pp. 343–345. Outline of project including collection conduits on west slopes, lining of Moffat Water Tunnel, siphons, and filtration plant.

Geneva, Switzerland. Recent Extensions of Water Supply of Geneva, Switzerland, A. Betant. *New England Water Works Assn.—J.*, vol. 49, no. 4, Dec. 1935, pp. 366–371. Construction of two new pumping plants on Lake Geneva—each equipped with 250-hp motor-driven centrifugal pump, which discharges water directly into network at rate of about 1,200 gal per min; also of two wells, each supplying 1.6 mgd.

Greece. Operation of Athens Water Supply, R. W. Gausmann. *Am. Water Works Assn.—J.*, vol. 27, no. 11, Nov. 1935, pp. 1458–1476. History and description of new water works of capital of Greece serving population of 800,000; quantity and consumption; quality of water; structures; billing and collecting.

Indo-China. French Indo-China Supply Secured Through American Methods, A. O. Beauchemin. *Water Works Eng.*, vol. 89, no. 2, Jan 22, 1936, pp. 67–71. Construction of modern water works for cities of Saigon and Cholon, Indo-China, with combined population of 350,000, including well contract to provide 30 mgd, gravity iron removal plant, and pressure iron removal plant; explorations made to avoid iron and salt in water; clay process seals off contaminated water.

Maintenance and Repairs. System Maintenance. *Eng. News-Rec.*, vol. 116, no. 22, May 28, 1936, pp. 767–780. Symposium on operation, maintenance, and repair of water works in United States, including following articles: Leakage Surveys, J. B. Eddy; Cold Weather Experiences; Crenothrix Chokes Conduits, G. E. Arnold; Load Factor Water Rate, W. A. Kunigk; Serving Ships with Water; Long Flume Service, B. H. Skillings; Handling Peaks at Sacramento; Artificial Ground Water, D. A. Lane; System Improvements.

Operation. Mechanical Control in Water-Works Operation, A. H. R. Thomas. *Am. Water Works Assn.—J.*, vol. 28, no. 1, Jan. 1936, pp. 6–21. Review of controls in general use in operation of municipal water works; pressure reducing valves; hydraulically operated gate valves; effluent rate controllers; automatic control of wash water; automatic control of solution feeders; automatic control of dry feeders; automatic chlorinators.

Paris. Municipal Water Supply of Paris, J. B. Hawley. *Am. Water Works Assn.—J.*, vol. 27, nos. 8 and 12, Aug. 1935, pp. 983–985, and Dec., pp. 1699–1703. History of water supply system of Paris, France, since ancient times; recent data on water consumption, reservoirs meters, and rates.

Rocky Mount, N.C. Complete Treatment Provided at Rocky Mount, N.C., Plant, P. J. Dishner. *Water Works Eng.*, vol. 89, no. 5, Mar. 4, 1936, pp. 240–243. PWA project costing $300,000 noteworthy for its architectural design and ample space allotted for equipment and operation; construction of filtration plant, rated at 3 mgd, complete with pumping equipment and erection of elevated steel tank, with capacity of 1,000,000 gal; heating and plumbing systems.

San Francisco, Design. Second Hetch Hetchy Pipe Line Is Laid Across Lower End of San Francisco Bay, L. B. Cheminant. *Western Construction News*, vol. 10, no. 3, Mar. 1935, pp. 65–71. General plan of Hetch Hetchy system; design of new line 21.25 miles long.

San Francisco Problems. Meeting Problems Resulting from Introduction of Hetch Hetchy Water, F. E. DeMartini. *Western Construction News*, vol. 10, no. 10, Oct. 1935, pp. 282–285. Sanitary and quality control over San Francisco supplies modified to meet changing conditions and varying problems following mixing of Hetch Hetchy water with local sources; algæ and crenothrix troubles.

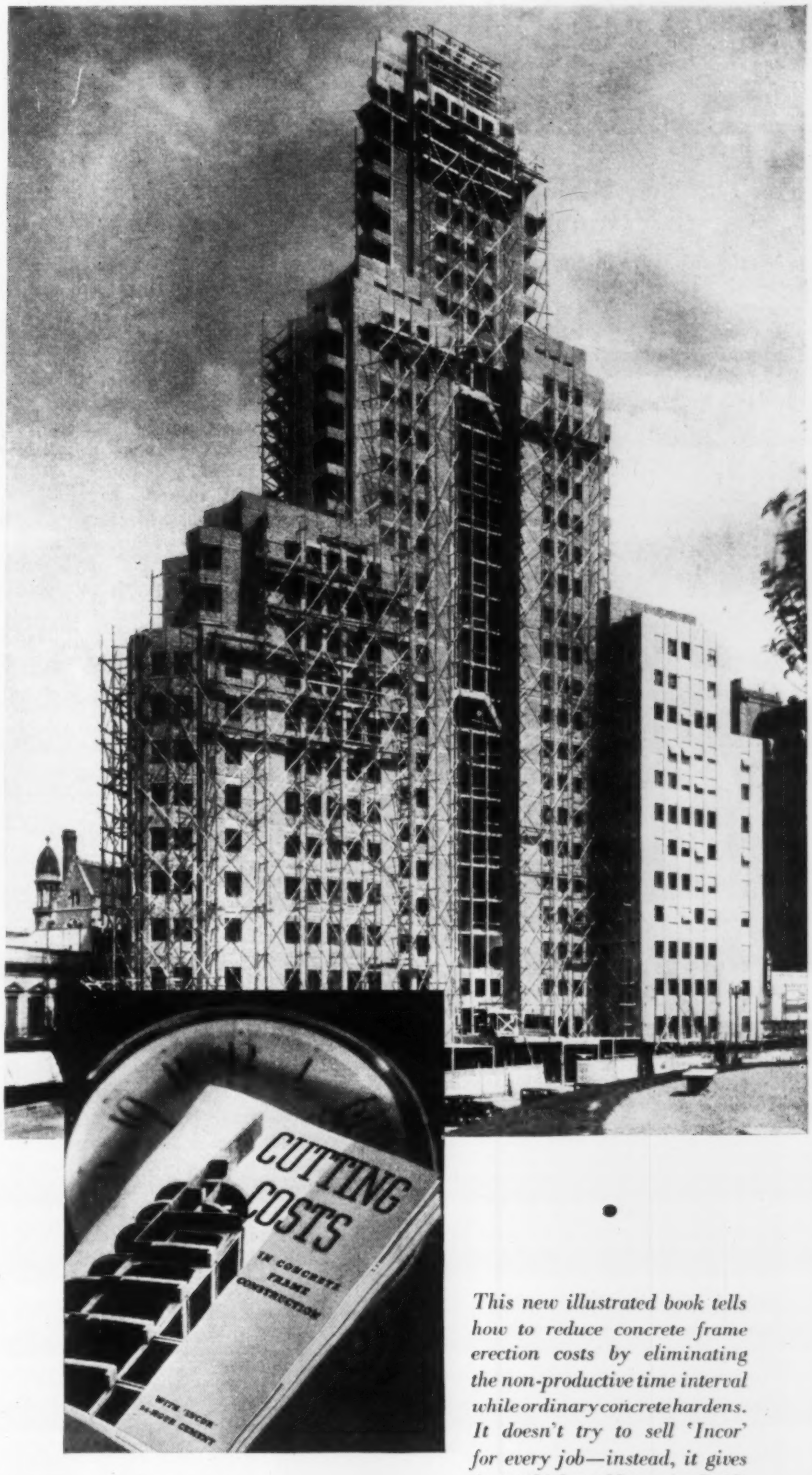
Wells. Some Central Texas Wells That Filled with Water, W. Kramer. *J. Geology*, vol. 43, no. 6, Aug.-Sept. 1935, pp. 644–652. Description of wells in which waters rise higher than local water table because of ground-water hydrostatic pressure generated by downward passage of water from surface through rocks, many of which, though called "impervious," are actually slowly permeable.

Wells, Contamination. Schaedlicher Einfluss von Aschenablagerungen auf Grundwasser, H. Haupt. *Gas- u. Wasserfach*, vol. 78, no. 27, July 6, 1935, pp. 526–529. Practical observations on contaminating effect of ash dumps on well waters of shallow origin.

Wells, Pumps. Deep Well Pumping, C. N. Ward. *Am. Water Works Assn.—J.*, vol. 28, no 3, Mar. 1936, pp. 361–368. Observations on recent general trend of developments; engineering and economic data on bucket pumps, air lift pumps, and turbine pumps; selecting deep well pumps.

CUTTING COSTS

IN CONCRETE FRAME CONSTRUCTION



FRAME-ERECTION costs divide two ways—direct costs for labor and materials, and indirect or overhead costs. Direct costs are pretty well fixed by job conditions; but indirect costs can often be substantially reduced by careful planning—and particularly by eliminating non-productive time. That is, by saving the time lost while ordinary concrete cures or hardens—"dead" days when frame-erection stands still and fixed overhead expense runs on.

Erection Schedules Analyzed

To save this non-productive time, the contractor can either build extra forms or use 'Incor' 24-Hour Cement, whichever is cheaper. But when to use which—that is the question. To get the answer, 80 typical erection schedules were analyzed. Results are summarized for quick reference in this new book (right).

This book shows, for both a 5- and 6-day week, the number of days required to erect and cure concrete frames, 1 to 16 floors, for four different form-assembly periods, with one and two sets of forms. It shows non-productive days saved by using 'Incor.'

Substantial Savings Shown

Thus, for any given overhead, you can quickly figure whether 'Incor' saves more than it costs. Since conditions vary widely from job to job, no specific costs are given—but you can easily figure the savings with the information supplied in this book. It's a quick, easy, accurate method—and usually the savings are well worth the estimating.

Write for free copy of "Cutting Construction Costs"—address Lone Star Cement Corporation (subsidiary of International Cement Corporation), Room 2204, 342 Madison Avenue, New York.

This new illustrated book tells how to reduce concrete frame erection costs by eliminating the non-productive time interval while ordinary concrete hardens. It doesn't try to sell 'Incor' for every job—instead, it gives facts which enable you to decide when to use it. Write for a free copy today.

(Above) Kavanagh Building, Buenos Aires, world's tallest reinforced concrete building. Cement furnished by International Cement Corporation's Argentine subsidiary.

* Reg. U. S. Pat. Off.

'INCOR' 24-HOUR CEMENT

Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

The New Owen Type RA Grapple

While this is the first formal announcement of the new Owen Type RA Grapple manufactured by The Owen Bucket Co., Cleveland, Ohio, the manufacturer reports that units have been in operation in various sections of the country for several months.

The most distinguished feature of this new Owen Grapple, as compared with the 4 tine grapple of conventional design, is the independent action of its tines. Instead of moving simultaneously toward the center in closing, any tine is capable of acting independently of the other 3 tines. This patented action, obtained by combining toggle operated tines and arm controlled tines, cause all 4 tines to grip any stone regardless of its shape, with practically equal pressure. This enables the operator to place the grapple more easily and quickly and to handle greater quantities of stone with a greater factor of safety.

Grapples with capacities from 3 to 60 tons are illustrated and described in the new bulletin just off the press.

New Jenkins Valves for Copper Piping

Jenkins Bros., 80 White St., New York, has introduced a complete line of Jenkins "Solder-End" Valves for 150 lb service on copper lines. Available at the same price are both the plain sweated and Mueller "Streamline" type ends, the latter being manufactured by Jenkins under license of Mueller Brass Co. With the exception of the ends, these new valves are identical with the standard Jenkins Valves used for threaded installations. An eight page folder, giving list prices and details on the different patterns, can be obtained from Jenkins Bros.

New Welding Electrodes Announced

An entirely new line of coated rods for d-c welding is now being made and sold through the Harnischfeger Corporation of Milwaukee, manufacturers of P&H-Hansen arc-welding equipment. The present line includes five different types with both high and low rates of fluidity for various types of work in welding in flat, vertical, or overhead positions and with ferrous and non-ferrous metals. Service tests show tensile strength of welds from 55,000 to 75,000 lb per sq in. with various types of rods ranging from $^3/_{32}$ to $^3/_8$ in. in size. "Smootharc" electrodes are designed primarily to speed up welding operations with a smoother, more easily handled arc and to reduce spatter losses. The new line is described in a new bulletin (No. R1), sent upon request.

New Development in Sewage Gas Meters

To provide increased insurance against the possible corrosive action of sewage gases, American Meter Co. announces a recent improvement in meters designed for measuring these gases.

All parts coming in contact with the gas are now either plated or made of special materials to minimize the effect of hydrogen sulphide when combined with the water vapor content. This feature is in addition to anti-corrosive precautions already characterizing the line of sewage gas meters. These corrosion resisting features are fully described in American Meter Company's new catalog EG40 which may be had on request to the company's publication department at 60 East 42d St., New York, or direct from American Meter factories and sales offices.

Allis-Chalmers Speed Patrols

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., announce the addition of tandem drive speed patrols to their line of road machines. The new patrols come in two sizes, one having 42 hp and the other 54 hp.

Constructed along the trend of modern automotive design the new A-C tandem patrols have many new features such as wide front axles for greater stability—wear take-up provision at all vital points—ball and socket connections—and hydraulic brakes of the internal expanding type. A complete range of tire equipment is available including both low and high pressure types in 4 or 8 wheel tandem assemblies to meet a wide variety of working conditions.

The model 42 weighs 15,350 lb and the model 54 weighs 17,000 lb. Speeds range from 2.3 to 10 miles per hr. An extra long blade base allows for maximum effective blade pressure and a huge circle, 5 ft, 4 in. in diameter, provides for rigid moldboard mounting and "chatterproof" performance.

A gear drive enclosed in an all-welded case transmits power from the drive shaft to the final drive axles. After exhaustive tests Allis-Chalmers found a gear drive to be the most satisfactory because it eliminates troubles such as noise, stretch, rapid wear and the need for constant adjustment which are encountered where chain drives are used.

A folder illustrating and describing the new machines can be obtained from Allis-Chalmers dealers or factory branches.

Minnehaha Avenue, Minneapolis, Minnesota. Tarvia-built in 1920, and as attractive, easy-riding and skid-safe today as it was sixteen years ago.

Barrett
TARVIA
GOOD ROADS AT LOW COST

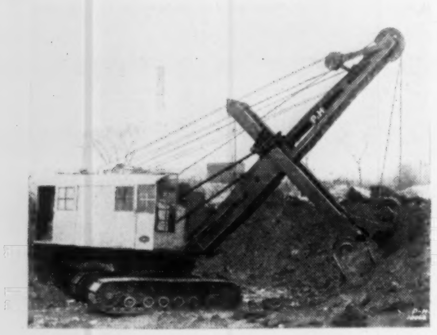
Since the first Tarvia road was built more than thirty years ago, highway engineers and Tarvia field men have worked together. The result is that today each Tarvia man has at his disposal an unmatched fund of road-building knowledge accumulated from reports and records from all parts of the country. He will gladly extend to you the opportunity to share in this background of sound, practical highway experience. 'Phone, wire or write our nearest office.

THE TECHNICAL SERVICE BUREAU of The Barrett Company invites your consultation with its technically trained staff, without cost or obligation. Address The Technical Service Bureau, The Barrett Company, 40 Rector Street, New York.

THE BARRETT COMPANY New York Chicago Birmingham Philadelphia Boston St. Louis Cleveland Minneapolis Lebanon Milwaukee Detroit Baltimore Columbus Youngstown Toledo Buffalo Providence Syracuse Hartford Cincinnati Bethlehem Rochester Portland, Me. Norwood, N. Y. In Canada: THE BARRETT COMPANY, LTD. Montreal Toronto Winnipeg Vancouver

Harnischfeger Presents New $1^{1}/_{2}$-Yd Shovel

SECOND in the new 700 series of Deisel powered excavators, announced this year by the Harnischfeger Corp. of Milwaukee, is the Model 705, a full-revolving machine with $1^{1}/_{2}$-yd capacity for which the builders claim increased operating speeds at a lower cost per yd.



Completely redesigned to take advantage of the newest developments in high tensile alloy steels and the use of arc welding, considerable emphasis has been laid upon weight reduction to obtain a higher ratio of horsepower per lb of weight, thus reducing the effect of inertia for faster operating speeds with lower fuel consumption.

Standard power on this new $1^{1}/_{2}$-yd machine is by a 6 cylinder Caterpillar Diesel engine rated at 130 hp at 900 rpm, although gasoline power is also available. The model 705 is fully convertible for service as shovel, dragline, crane, trench hoe, skimmer, or pile driver.

An attractive 16-page booklet covering design and operation of this new machine is now being released. Copies may be had by addressing the home offices of the corporation at Milwaukee. Bulletin X-4.

Link-Belt Issues New Power Transmission Catalog

THE LINK-BELT CO. announces the publication of a new 208-page catalog No. 1500 devoted exclusively to power transmission equipment.

The new book features the line of Link-Belt anti-friction roller-bearing units, as well as an entirely new group of streamlined babbitted bearings, several new types of take-ups, and many other new products. Drop hangers, cast iron, and pressed steel; pulleys of all types, including steel split construction; gearing, cast and cut tooth types; shafting; shaft couplings, rigid and flexible; safety collars; and grease fittings, are also included.

The book contains many illustrations, gives dimensions, weights, and list prices, and contains a cross-reference index for the convenient use of engineers and plant managers.

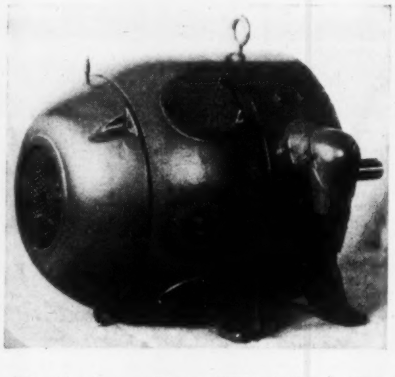
Copies of this book will be sent on requests addressed to the Link-Belt Co., 2410 West 18th Street, Chicago, or to the nearest office of the company.

The SKF Grip-Lock Bearing

THE SKF Grip-lock bearing is the latest addition to the SKF line of anti-friction bearings. The Grip-lock principle offers the advantage of quick, simple application of the bearing without tools of any kind and insures the user of a bearing positively locked to the shaft. Essentially, the bearing is the SKF self-aligning extended inner race bearing with an eccentric groove machined in the bore of the inner race. Fitted in the eccentric groove is a piece of spring steel known as the Grip-lock shoe. When the shoe is in the deepest part of the eccentric groove the bearing may be readily slipped on the shaft. Then, by holding the inner race of the bearing while the shaft turns in the direction of operation, the knurling at the ends of the grip-lock shoe grips the shaft, causing the shoe to wedge in the shallow part of the eccentric groove and thus securely locking the bearing on the shaft.

New Fan Cooled Totally Enclosed D-C Motor

DESIGNED for general industrial service and particularly for use in cement plants, coal tipples, rock products plants, machine shops, steel mills, etc., where abrasive and metallic dust is present and in chemical plants, dye houses, canneries, packing houses, breweries, etc., where splashing liquids and mild chemicals are encountered, a new line of fan cooled totally enclosed direct current motors is announced by Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. Sizes of the new SK motor range from 5 to 75 hp for 115, 230 and 550 volts direct current.



Westinghouse Type SK totally enclosed fan cooled motors are built so that all foreign matter and splashing liquids are excluded from the interior of the motor. However, only one cover of the new motor need be removed to gain access to the brushes and commutator.

This design has a distinct advantage that permits mounting the pulley or pinion close to the supporting bearing. Also, the motor may be mounted close to a wall or gear box at the pulley end without interfering with the free flow of ventilating air. The flexibility in this construction also permits adaption, with some modifications, for waterproof and explosion tested applications.

Folders Announced

Carryall Scrapers, $8^{1}/_{2}$ by 11 in., 16 pages, illustrated. R. G. LeTourneau, Inc., Peoria, Ill.

Welding and Cutting High Chromium Steels, $8^{1}/_{2}$ by 11 in., 8 pages, illustrated. Linde Air Products Company, New York, N.Y.

Dry Feeder Machines for Water, Sewage Disposal and Industrial Processes, $8^{1}/_{2}$ by 11 in., 4 pages, illustrated. Syntron Company, Pittsburgh, Pa.

Specification for Asphalt Surface Treatment of Waterbound Surfaces, 5 by 7 in., 8 pages

Specification for Asphalt Surface Treatment of Loosely Bonded Surfaces, 5 by 7 in., 8 pages

Specification for Patching, Reducing Crown and Correcting Profile, 5 by 7 in., 8 pages. Above three by Asphalt Institute, 801 Second Avenue, New York, N.Y.

Southwark Heydekampf Testing Machines, Bulletin No. 99, $8^{1}/_{2}$ by 11 in., 8 pages, illustrated. Baldwin-Southwark Corporation, Philadelphia, Pa.

Southwark R. D. Type Universal Testing Machines, Bulletin No. 102, $8^{1}/_{2}$ by 11 in., 6 pages, illustrated. Baldwin-Southwark Corporation, Philadelphia, Pa.

LeTourneau Angledozers, $8^{1}/_{2}$ by 11 in., 12 pages, illustrated. R. G. LeTourneau, Inc., Peoria, Ill.

Pomona's Hydraulic Test Laboratory, $8^{1}/_{2}$ by 11 in., 6 pages, illustrated. Pomona Pump Co., Pomona, Calif.

Cornell Rolling Grilles, $8^{1}/_{2}$ by 11 in., 8 pages, illustrated. Cornell Iron Works, Long Island City, N.Y.

Self-Closing Vertical Lift Fire Door, $8^{1}/_{2}$ by 11 in., 2 pages, illustrated. Cornell Iron Works, Long Island City, N.Y.

Caterpillar Diesel on the Farm, $8^{1}/_{2}$ by 11 in., 8 pages, illustrated. Caterpillar Tractor Co., Peoria, Ill.

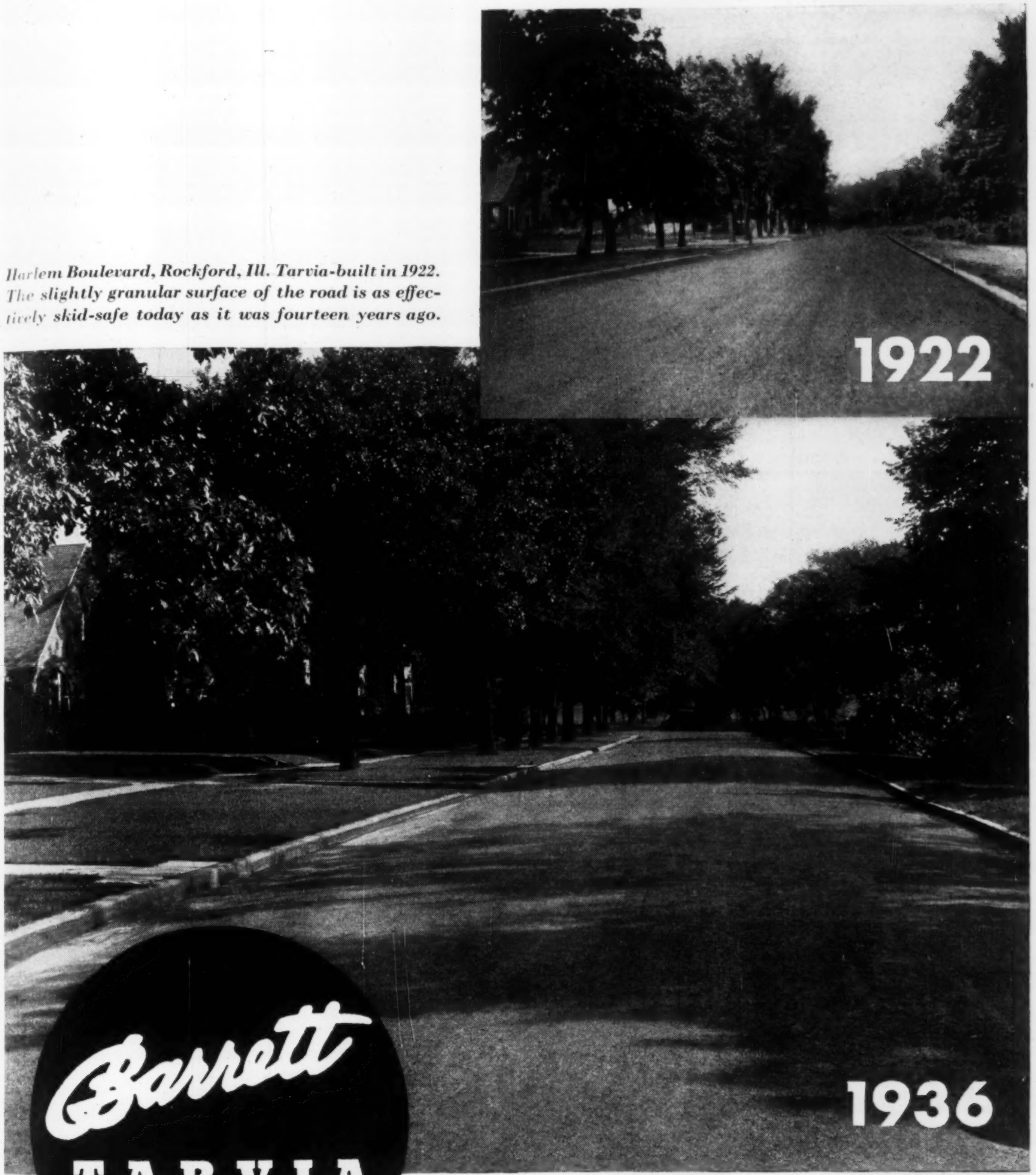
New Caterpillar Tractors—Diesel RD-4 and Thirty, $8^{1}/_{2}$ by 11 in., 12 pages, illustrated. Caterpillar Tractor Co., Peoria, Ill.

Asbestos Bonding—Armco Asbestos Bonded Paved Invert Pipe, $8^{1}/_{2}$ by 11 in., 12 pages, illustrated. Armco Culvert Manufacturers Association, Middletown, Ohio.

A New Bulletin on Unitair Compressors

THE UNITAIR is a two-stage, completely air-cooled, V-type, single acting stationary compressor incorporating many advanced features in compressor design. The manufacturer reports that the Unitair can be installed in a short time; will operate on little foundation; and is designed for 24-hr service. The compressors are available in four sizes to 400 C.F.M. displacement and for any kind of drive: built-in electric motor; direct connection or V-belt drive from motors and gasoline, distillate, or diesel power units. Write for Bulletin 88-0. Sullivan Machinery Company, Dept. 21, Michigan City, Indiana.

Harlem Boulevard, Rockford, Ill. Tarvia-built in 1922. The slightly granular surface of the road is as effectively skid-safe today as it was fourteen years ago.



Barrett

TARVIA

GOOD ROADS AT LOW COST

Today, more than ever, the need is for *skid-safe* roads. Modern high-speed automobiles, quicker braking and greatly increased traffic place a heavy responsibility upon highway builders. No special method is necessary to make Tarvia roads lastingly skid-safe. Tarvia penetrates deeply, holding the stone or gravel firmly exposed on the road surface to give tires an effective grip that minimizes the skid hazard. Ask the Tarvia field man about it.

THE BARRETT COMPANY New York Chicago Birmingham Philadelphia Boston St. Louis Cleveland Minneapolis Lebanon Milwaukee Detroit Baltimore Columbus Youngstown Toledo Buffalo Providence Syracuse Hartford Cincinnati Bethlehem Rochester Portland, Me. Norwood, N. Y. In Canada: THE BARRETT COMPANY, LTD. Montreal Toronto Winnipeg Vancouver

Hill, Henry Osborne, Jun., Amarillo, Tex. (Elected Dec. 22, 1930.) (Age 27.) Senior Soil Conservationist in Research, Soil Conservation Service, U. S. Dept. of Agriculture. Refers to V. L. Austin, T. B. Chambers, C. E. Ellsworth, L. A. Jones, C. E. Ramser.

Latham, William Harris, Jun., Forest Hills, N.Y. (Elected Dec. 3, 1926.) (Age 32.) Cons. Park Engr., Dept. of Parks, and Park Engr., Henry Hudson Parkway Authority, New York City. Refers to C. B. Breed, A. E. Howland, I. V. A. Huie, R. P. Lent, E. Praeger, C. S. Proctor, D. B. Steinman.

Lawler, Philip Symmes, Jun., San Francisco, Calif. (Elected Dec. 22, 1930.) (Age 32.) Estimator, Appraiser and Designer, Lauriston Investment Co. Refers to C. Derleth, Jr., J. J. Gould, H. L. Kegler, L. H. Nishkian, G. E. Troxell.

Li, Wen-Pang, Jun. Canton, Ohio. (Elected Oct. 1, 1928.) (Age 30.) Harbor Engr., River Conservancy Comm., Kwangtung Province, National Govt., Prof. and Head, Dept. of Civ. Eng. Kwangtung Kuo-min Univ., Canton, China. Refers to H. Cross, J. C. L. Fish, W. C. Huntington, C. G. Hyde, L. B. Reynolds.

Moore, Walter Parker, Jun., Houston, Tex. (Elected Oct. 10, 1927.) (Age 32.) Cons. Engr. Refers to E. A. Fretz, J. M. Howe, L. B. Ryon, Jr., L. H. Schlom, L. V. Uhrig.

Morgan, Benjamin Arthur, Jr., Jun., Clemson, S.C. (Elected July 25, 1932.) (Age 22.) Res. Engr., J. E. Sirrine, & Co., Inc. Refers to A. W. Brooks, J. E. Deignan, H. L. Hagerman, A. L. Hertz, R. L. Klotz, W. S. Lindsay, L. B. Moore, E. S. Randolph, J. E. Sirrine.

Pletta, Dan Henry, Jun., Blacksburg, Va. (Elected Jan. 25, 1932.) (Age 32.) Asst. Prof. of Applied Mechanics, Virginia Polytechnic Inst. Refers to E. E. Bauer, R. B. H. Begg, H. Cross, W. C. Huntington, F. J. Sette.

Ricketts, Henry Palmer, Jun., Little Rock, Ark. (Elected Nov. 14, 1927.) (Age 32.) Asst. Engr., U.S.R.A. Refers to H. F. Bucher, W. O. Dixon, W. E. Ford, K. W. Lefever, G. A. Watkins.

Root, Ismar Earl, Jun., Stapleton, N.Y. (Elected May 13, 1935.) (Age 32.) Jun. Asst. Engr., Grade 2 (Field), New York State Transit Comm. Refers to G. T. Larson, R. P. Lent, W. Mueser, W. L. Selmer, S. Shapiro, E. W. Wolf.

Rubin, Joseph Leonard, Jun., Brooklyn, N.Y. (Elected Feb. 10, 1930.) (Age 32.) Engr. and Supt. of Constr., Spencer, White & Prentis Inc., New York City. Refers to H. T. Immerman, W. T. McIntosh, G. Paaswell, E. A. Prentis, C. B. Spencer, L. White.

Sagehorn, Ernest Henry, Jun., Stockton, Calif. (Elected Oct. 1, 1928.) (Age 33.) Jun. Bridge Constr. Engr., California Dept. of Public Works. Refers to E. N. Bryan, B. A. Etcheverry, J. Gallagher, H. J. Gault, E. Hyatt, F. W. Panhorst.

Thomas, Charles Walter, Jun., Montrose, Colo. (Elected April 22, 1935.) (Age 30.) Asst. Engr., Hydr. Laboratories, U. S. Bureau of Reclamation. Refers to E. W. Lane, R. L. Parshall, C. Rohwer, J. L. Savage, J. E. Warnock.

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

Men Available

These items are from information furnished by the Engineering Societies Employment Service, with offices in Chicago, New York, and San Francisco. The Service is available to all members of the contributing societies. A complete statement of the procedure, the location of offices, and the fee is to be found on page 87 of the 1936 Year Book of the Society. To expedite publication, notices should be sent direct to the Employment Service, 31 West 39th Street, New York, N.Y. Employers should address replies to the key number, care of the New York Office, unless the word Chicago or San Francisco follows the key number, when it should be sent to the office designated.

CONSTRUCTION

Civil Engineer; Jun. Am. Soc. C.E.; single; B.S.C.E., 1930. Experienced in building, oil refinery, and railroad construction—chief of party; 2½ years in planning and time-study work; after graduation took course in cost accounting. Wants position in construction (planning and costs) or with insurance company as inspector. C-8602.

Construction Engineer; Assoc. M. Am. Soc. C.E.; 29; single; graduate civil engineer, New York University, 1930; 5 years with contractor on subway and vehicular tunnels; field engineer and assistant to chief engineer on subsurface construction (compressed air) and all hydrographic dredging, surveying, etc. Desires work with general contractor on new construction. Employed; available in one month. D-1921.

Construction Engineer and Superintendent; M. Am. Soc. C.E.; member of Canadian Institute of Civil Engineers; professional engineer and land surveyor, New York and New Jersey; considerable experience on construction of tunnels—compressed air, vehicular, and rock; subways, sewerage and water systems, reservoirs, and heavy construction of all kinds. Salary depends on location, etc. D-5015.

Construction Engineer; Assoc. M. Am. Soc. C.E.; 39; graduate civil engineer; registered professional engineer, State of Pennsylvania; 13 years experience, including railroad maintenance, dredging, many types of heavy concrete and steel construction, land surveying; over 6 years on two of the largest suspension bridges. Available immediately. D-5277.

Construction Engineer; Assoc. M. Am. Soc. C.E.; 40; married. Registered professional engineer; broad experience all forms of construction; specialist in concrete and road building; good organizer and administrator. Former contractor and can qualify as office manager, field superintendent, or public relations man. Best references. Available immediately. West coast preferred. D-5324-368-A-2 San Francisco.

DESIGN

Structural and Hydraulic Design Engineer; Assoc. M. Am. Soc. C.E.; 30; B.Sc., C.E., 1929; professor, C.E. degree, 1936; 7 years on design of bridges, buildings, power and irrigation canals, control structures, and diversion dams. Excellent experience. References. Now employed; soon available. D-5317.

Civil Engineer; M. Am. Soc. C.E.; licensed professional engineer, New York and New Jersey; 15 years with one company, in charge of design and details. All types of railroad structures, steel and reinforced concrete; office and field; 15 years varied experience on important construction jobs. Large bridges, industrial buildings, estimates, design, rapid-transit systems. Difficult foundations, rigid-frame structures. C-5109.

Civil and Structural Engineer; Assoc. M. Am. Soc. C.E.; 37; married; graduate of Michigan State College; New York license; 8 years experience in building and structural design; 3 years varied experience, including aerial-photo compilation; location immaterial. C-7048.

EXECUTIVE

Sales Engineer; M. Am. Soc. C.E.; registered engineer, Pennsylvania. For over 25 years connected with steel construction and general contracting. Thoroughly qualified and experienced in the various branches of engineering, sales, operations, and construction. Available immediately. C-5095.

Municipal Engineer and City Manager; Assoc. M. Am. Soc. C.E.; age 44; married; graduate; 20 years experience; Ohio and Michigan registration; 4 years as city engineer—building, planning, and zoning; 1 year federal relief work. Economical administration. C-5640.

Civil Engineer; Jun. Am. Soc. C.E.; 30; married; C.E., University of Maryland; 1½ years survey with water and sewer commission; 2 years building construction, including foundation piling and superstructure; 1 year hydraulic dredging, subaqueous surveys, test borings, bids, and estimates; 1 year drafting and design of buildings. Capable of handling men. D-4983.

Promotion and Construction; Assoc. M. Am. Soc. C.E.; New York State license; graduate of Rensselaer Polytechnic Institute; married; 45; 13 years as construction foreman and field engineer in industrial design; 12 years fire-protection, trade extension, building-code, and legislation expert—consultant and executive manager. Competent speaker, versatile, with good address; seeks responsible position, New York headquarters, on difficult, productive work. B-3727.

Hydraulic and Structural Engineer; Assoc. M. Am. Soc. C.E.; age 33; married; graduate; 12 years experience on investigation, surveys, design, estimate, construction, and maintenance of large and small hydro-electric developments, domestic and foreign. Desires connection with power company. Available on reasonable notice. C-3752.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 34; married; graduate civil engineer, 1924; Michigan license; 12 years progressive experience on surveying, specifications, estimates, contracts, design of heavy and difficult hydraulic works and power structures, tunnels, pipe lines, sewers, railroad track layout, retaining walls, foundations, heavy buildings, roads, and highways. Capable of supervision. C-9870.

JUNIOR

Civil Engineer; Jun. Am. Soc. C.E.; 23; married; B.S.C.E., Lafayette, 1935; Tau Beta Pi. Short time with U. S. Coast and Geodetic Survey; hydraulics, piping, testing department. Past 10 months, bridge office of large railroad, computing, estimating, detailing, drafting. Desires opportunity in any branch of civil engineering. Location immaterial if salary is reasonable. D-4149.

Engineer; Jun. Am. Soc. C.E.; 24; single; B.S. in C.E., Newark College of Engineering, 1934; also B.S. in E.E., June, 1936, same college; 6 years experience in electrical construction. Desires opportunity in either civil or electrical engineering or a combination of both; location anywhere in the United States; available immediately. D-5323.

O EVERY USER AND PROSPECTIVE USER OF DIESEL POWER

Save Money with a HEAVY DUTY Diesel!

● Stop and consider before you buy any Diesel! As manufacturers of both light and heavy duty Diesel engines, Fairbanks-Morse can, without prejudice, point out where each type best fits any specific power requirement.

For continuous service, in most cases, it is better engineering and better business to install a HEAVY DUTY engine. For example, if you now require an engine for seasonal operation, such as irrigation or cotton ginning —for continuous operation, such as milling, the F-M Model "32" heavy duty engine will render this service at a lower over-all cost and give you the additional protection of its capacity for 24-hour, full load running.

Because the Model "32" brings you the important advantages of two-cycle, back-flow scavenging operation, you secure added fuel economy and greatly reduced maintenance. No valves to grind—consequently no drop in engine efficiency between valve reconditioning periods.

The price of these engines is remarkably low. Do not let a mistaken impression of first cost prevent your getting the maximum in present and future savings. Write Department L-541, Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill. 34 branches at your service throughout the United States.

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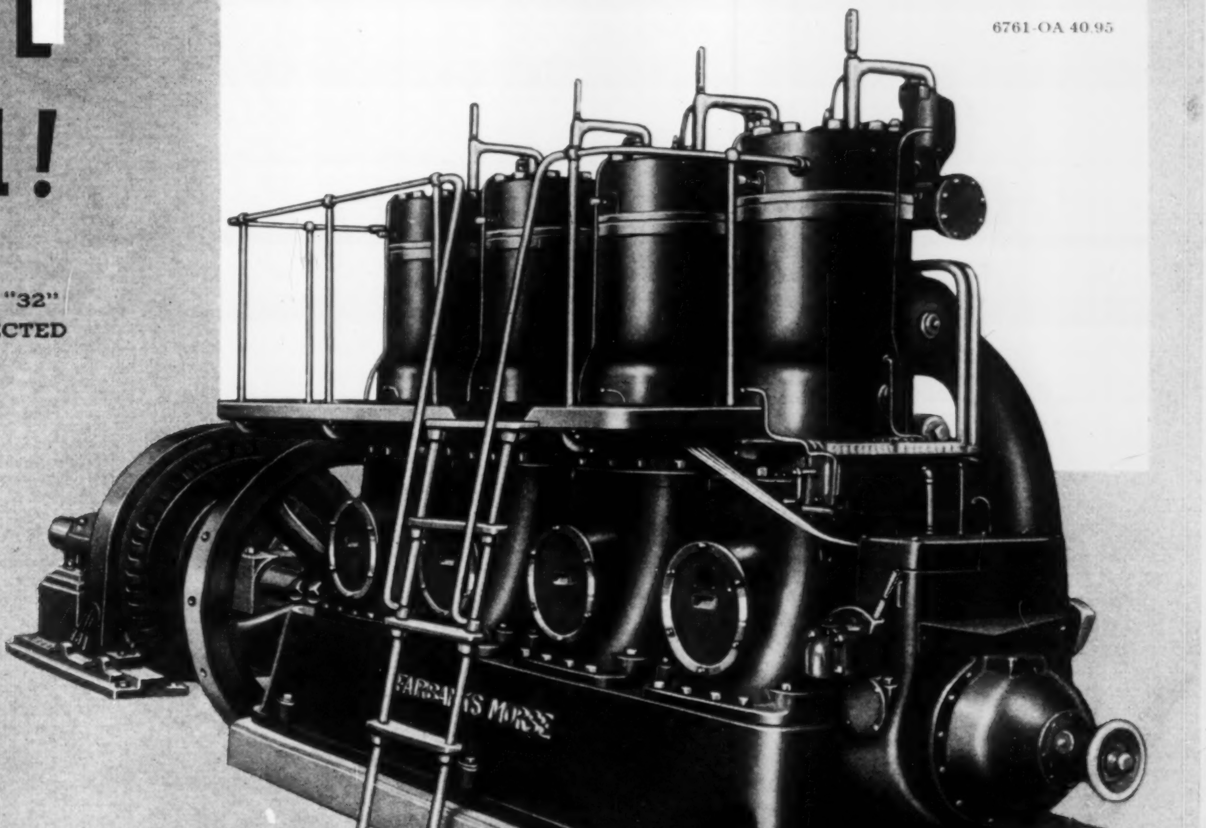
FAIRBANKS-MORSE MODEL "32"
DIESEL WITH DIRECT CONNECTED
ALTERNATOR



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AIRBANKS-MORSE
Diesel Engines
OWER, PUMPING AND WEIGHING EQUIPMENT

106
YEARS OF
PRECISION
MANUFACTURING

Graduate Civil Engineer; Jun. Am. Soc. C.E.; 24; married; B.S.C.E. (magna cum laude), University Southern California, 1934; 2 years experience, including computations on plant appraisal, surveying, and inspection on plant construction, and work as building inspector. Excellent references. Principally interested in surveying, design, or construction. Available 2 week's notice. Location, West Coast, preferably California. D-5273-367-A-1 San Francisco.

Civil Engineer; Jun. Am. Soc. C.E.; 25; single; Rensselaer Polytechnic Institute, 1935; 3 years varied experience, as instrumentman and inspector on highway and building construction and engineering drafting. Now employed in U. S. Dept. of Agriculture as draftsman, but prefers connection with reliable private engineering organization offering opportunities for advancement. Location immaterial. D-5271.

Civil Engineer; Jun. Am. Soc. C.E.; 25; single; C.E., Rensselaer Polytechnic Institute; graduate work, Polytechnic Institute of Brooklyn; 2 years industrial experience; 18 months in responsible charge of maintenance work; wants position in appraisal work, factory layout, maintenance, or industrial engineering; available on short notice. D-1971.

Engineer; Jun. Am. Soc. C.E.; young; married; graduate; experience with the Board of Health, Chicago, Ill.; desires position in public health engineering, preferably in the West. Member A.Ph. A. D-5311.

Civil Engineer; Jun. Am. Soc. C.E.; B.S.E., C.E.; 24; experienced surveyor, topographical draftsman, concrete designer, and estimator. Desires employment in any branch of civil engineering. Location immaterial. Salary secondary. Available immediately. D-5314.

Civil Engineer; Jun. Am. Soc. C.E.; 29; single; A.B. degree, Columbia University; B.S. in C.E., University of Colorado; 2 years highway experience; 2 years small, private home building; one year as inspector, later personnel employment work, with PWA and Home Relief Bureau, New York; now employed in foreign sewage survey; knowledge of Arabic; familiar with Arab labor; location immaterial. D-2611.

Civil Engineer; Jun. Am. Soc. C.E.; 26; single; B.S.C.E., 1933; 3 years varied experience, including survey, design, and construction of roads and highways. Executed research on bituminous pavings. Built Amesite plant. Also interested in foreign service. Location immaterial. Now available. D-4740.

Civil Engineer; Jun. Am. Soc. C.E.; 27; single; B.S., 1933; C.E., 1934; sanitary and structural option, Columbia University; 13 months computer, U. S. Coast and Geodetic Survey; 4 months topographic draftsman; 9 months draftsman on marine work. Employed now. Desires position on construction or design in sanitary or structural fields. Available one week's notice. D-3061.

Miscellaneous

Municipal Engineer; Assoc. M. Am. Soc. C.E.; licensed professional engineer, New Jersey; age 35; married; graduate; 10 years varied experience in design, supervision of construction, and maintenance of public utilities as assistant city engineer. Desires work with public works agency on utility installation and maintenance. Employed. Available two weeks. D-5254.

Teaching

Instructor, Civil and Highway Engineering; Jun. Am. Soc. C.E.; 31; single; civil degree, Pennsylvania State College; majored in highway engineering; minored in city planning, city manager; 5 years highway engineering, surveys, design, construction, research; 2 years as instructor (engineering mathematics); experienced tutor; public speaker; engineering publicity, publication work; university faculty position desired, with opportunity for research study. D-2776.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 38; married; member S.P.E.E.; registered professional engineer and land surveyor; B.S., M.S., and C.E. degrees. Varied practical experience; ex-soldier; 6 years experience teaching structural theory and design, engineering mechanics, and other courses. Associate professor. Desires new location with greater responsibility and opportunity. D-5090.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1936. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

Beihefte zum Gesundheits-Ingenieur. Reihe 2, Heft 16. Ed. by Gesundheits-Ingenieur. Die Bewegung der Schwerstoffe in Flachgeneigten Rohren unter Besonderer Berücksichtigung von Steinzeugrohren mit Praktischen Anwendungen, by G. P. Karakassonis. Munich and Berlin, R. Oldenbourg, 1936. 25 pp., illus., diagrs., charts, tables, 12 × 9 in., paper, 4.80 rm.

This essay presents the results of laboratory studies of the flow of heavy materials in slightly inclined stoneware pipes. The practical applications of the findings in the design of drains and sewers are discussed.

Dams—A Bibliography of Books, Periodicals, and Society Publications Appearing from January 1924 through March 1936. Compiled by Alvan W. Clark. Fort Belvoir, Va., The Engineer School, 1936. 256 pp., 9 × 6 in., paper, 75 cents (apply above).

This comprehensive bibliography is in loose-leaf form so that new pages may be inserted at intervals in the proper order, to keep it up to date. References to many allied subjects—such as fishway problems, for instance—are included in this volume, which covers foreign countries as well as the United States.

Directory of Organizations in the Field of Public Administration, 1936. Chicago, Ill., Public Administration Clearing House (850 East 58th Street), 1936. 180 pp., $9^{1}/_{2}$ × 7 in., paper, $1.

This volume, which is the third edition of the Directory, lists and describes more than five hundred national organizations active in the field of public administration. It is a guide to sources of information on all types of governmental problems and a valuable reference tool for those studying or working in the field of public administration.

Frontiers of Science. By C. T. Chase. New York, D. Van Nostrand Co., 1936. 352 pp., illus., 9 × 6 in., cloth, $3.75.

The purpose of this book is to "visit each of the present frontiers of science, to see what is being done there, and to make inquiry as to the possible effect of this work on human destiny and on man's idea of his place in the universe. . . ." Dr. Chase reviews progress in astronomy and astrophysics, atomic physics and physical chemistry, organic chemistry, biochemistry, and health.

Hydro-Electric Power Stations. By E. A. Crellin. Scranton, Pa., International Textbook Co., 1935. illus., diagrs., charts, tables, 8 × 5 in., leather, $1.60.

An elementary text on design and construction which treats the subject descriptively.

Inventing the Ship. By S. C. Gilfillan. Chicago, Follett Publishing Co., 1935. 294 pp., illus., diagrs., charts, tables, 8 × 6 in., cloth, $2.50.

In this volume, which is a self-contained companion to the *Sociology of Invention*, the principles of invention claimed by the author are applied to an account of the inventions through which the ship of today has been developed from the first boat. The book is a graphic history of the ship, readable and interesting.

Mitteilungen der Deutschen Materialprüfungsanstalten. Sonderheft XXVII. Berlin, Julius Springer, 1936. 119 pp., illus., diagrs., charts, tables, 12 × 6 in., paper, 9.60 rm.

This number contains sixteen reports of investigations carried out at the Staatliche Materialprüfungsamt in Berlin. Among the subjects are the static effect of reinforcements of massive masonry structures; the resistance of roofing papers to weather; the heat conductivity and weather resistance of safety glass; the improvement of the fire resistance and bearing strength of masonry; and the corrosion of zinc gutters by tar roofs.

Pioneer Southern Railroad from New Orleans to Cairo. By T. D. Clark. Chapel Hill, University of North Carolina Press, 1936. 171 pp., diagrs., 9 × 6 in., cloth, $2.

This is a history of the beginnings of railroad building in Louisiana and Mississippi, and of the construction of the roads which eventually became the southern division of the Illinois Central system. The difficulties of financing and building these roads are depicted thoroughly in an interesting contribution to railroad history.

Poor John Fitch, Inventor of the Steamboat. By T. Boyd. New York, G. P. Putnam's Sons, 1935. 315 pp., illus., 9 × 6 in., cloth. $3.00.

This new biography of the unhappy pioneer of the steamboat presents an interesting detailed account of his tragic life, based largely upon an unpublished autobiography and other manuscripts. Fitch's steamboat was the first on American waters and ran for several thousand miles. Commercially, it was unsuccessful, chiefly for economic reasons which Fitch never understood. The book recalls attention to a man who is undeservedly forgotten.

Principles of Warship Construction and Damage Control. By G. C. Manning and T. L. Schumacher. Annapolis, Md., United States Naval Institute, 1935. 396 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $4.50.

The aim of this text, prepared for use at the U. S. Naval Academy, is to present the principles involved in the control of hull damage in battle. The principles of naval architecture and the structural parts of the ship are discussed thoroughly, but from the viewpoint of the operating personnel, not the designer or builder. The new edition has been fundamentally revised.

Theorie der Setzung von Tonschichten, eine Einführung in die analytische Tonmechanik. By K. v. Terzaghi and C. K. Fröhlich. Leipzig and Vienna, Franz Deuticke, 1936. 166 pp., diagrs., charts, tables, 10 × 7 in., paper, 12 rm.; bound, 14.40 rm.

This volume, which discusses the mechanics of the settlement of loaded strata of clay, is an important contribution to the literature on soil mechanics. The book treats of the mathematical evaluation of the basic equation for calculating the course of settlement of such strata and of the determination of the fundamental concepts that are necessary to predict the possibility of settlements in foundations and to provide remedies.

Die Wasserversorgung. 2 Vols. By J. Brix, H. Heyd, and E. Gerlach. Munich and Berlin, R. Oldenbourg, 1936. Illus., diagrs., charts, tables, 10 × 7 in., paper, Vol. 1, 151 pp.; Vol. 2, 159 pp. (18.50 rm., 2 vols.).

This work aims to fill the need for a concise, yet comprehensive, introduction to the study of water-works engineering. The first volume treats the general questions of water supply; the second, the design, construction, and operation of distribution systems. The first volume contains a comprehensive bibliography of German books and articles published in the period 1930–1935.

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CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Magazines in This Country and in Foreign Lands

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BRIDGES

Concrete Arch, Germany. Die Bruecke ueber den Neckar im Zug der Kraftfahrbahn Frankfurt (M) - Heidelberg - Mannheim, Weiss. *Bauingenieur*, vol. 16, nos. 49/50, Dec. 6, 1935, pp. 491–496. Design and construction of concrete arch highway bridge over Neckar River between Mannheim and Heidelberg, Germany, consisting of six spans from 55 to 76 m in length; construction of arches and details of arch centering.

Design. Bridge as Waterway, R. A. Ryves. *Surveyor*, vol. 88, nos. 2274, 2275, 2276, and 2277, Aug. 23, 1935, pp. 199–200; Aug. 30, pp. 219–220; Sept. 6, pp. 247–249; and Sept. 13, pp. 273–274. Types of streams; location of openings; scour and silting; runoff and velocities of flow; features of existing works.

Design, Architectural. Engineer and Architect in Bridge Work, A. W. Legat. *Concrete & Constr. Eng.*, vol. 31, no. 3, Mar. 1936, pp. 161–173. Principles of architectural treatment of arch and girder bridges, including approaches; concealment of hinges; spandrel walls; parapets; treatment of parapet girders; colored cement; surface finishes.

Floors. Open Mesh Steel Deck for Flood-Damaged Bridge, H. S. Ayres. *Eng. News-Rec.*, vol. 116, no. 24, June 11, 1936, pp. 845–846. Repairing Second Avenue Bridge, Pittsburgh, Pa., which was damaged by recent floods; use of open mesh to provide self-cleaning, non-float, non-skid, light-weight floor that would safely carry H-10 loading.

Highway. Highway Bridge Building, G. E. Ashforth. *Surveyor*, vol. 88, no. 2292, Dec. 27, 1935, pp. 741–742. Recent improvements in design; foundation problems; stability of old brick bridges.

Masonry Arch, History. Demolition of Waterloo Bridge, E. J. Buckton and H. J. Fereday. *Civ. Eng. (London)*, vol. 31, no. 359, May 1936, pp. 151–162. History of bridge with detailed drawings and account of demolition operations. Before Instn. Civ. Engrs.

Steel Arch, Denmark. Storstrom Bridge, A. Engelund. *Civ. Eng. (London)*, vol. 30, Aug. 1935, pp. 236–248. Combined highway and railway bridge connecting Copenhagen with mainland; 10,534 ft long with 49 concrete piers and three steel-plate girder navigation spans reinforced by polygonal arch.

Steel Truss, Failure. Excessive Bridge-Deck Maintenance, J. L. Davis. *Eng. News-Rec.*, vol. 116, no. 24, June 11, 1936, p. 841. Collapse of Vermont highway steel-truss bridge, 42 ft long, due to overloading by repeated additions of gravel to roadway.

Suspension, Quebec. Design and Construction of Island of Orleans Bridge Suspension Span, P. L. Pratley. *Can. Engr.*, vol. 70, nos. 2 and 4, Jan. 14, 1936, pp. 5–9, and Jan. 28, pp. 5–7. January 14: Design of deck, stiffening trusses, cables, and main towers; January 28: Cable bents, pre-stressing of cable strands, and erection of suspension span.

Suspension, Widening. Rapid Transit Begins Across Philadelphia–Camden Bridge, L. B. Manley and S. Harris. *Eng. News-Rec.*, vol. 116, no. 23, June 4, 1936, pp. 811–814. Opening of two-track railway for multiple-unit electric train service between Philadelphia and Camden, over Delaware River suspension bridge, on existing cantilever brackets outside stiffening trusses; stations and underpasses; design features; track work; construction details; supervision and personnel.

Viaducts, Steel. Shift 90-Ft Tower Between Trains in Viaduct Renewal. *Ry. Age*, vol. 100, no. 20, May 16, 1936, pp. 792–795. Unique replacement procedure adopted by Nickel Plate Company at State Line, Pa., to permit new columns to rest on old pedestals; mortar cap over cover plates evens up girder flanges to receive pre-cast floor slabs.

BUILDINGS

Apartment Houses, Design. From Rent to Space, B. J. Harrison, Jr., H. D. Whitney, and C. Woodward. *Arch. Forum*, vol. 64, no. 6, June 1936, pp. 445–460. Apartment planning technic, starting with rentals tenants can pay, defining living space these rentals will support, and presenting method for planning within established limits by tests which check solution at each major stage; tenants' housing needs; financial tests; site selection; building design; site plan; project summary.

CITY AND REGIONAL PLANNING

Berlin. Die Altstadtgesundung in Berlin, B. Kuehn. *VDI Zeit*, vol. 80, no. 23, June 6, 1936, pp. 710–713. Improving housing conditions in old sections of Berlin; necessity for improvement in central sections of city; plans for improving various squares and streets; central market building; plan drawings and illustrations of improved sections.

New England. Basic Data for Tentative and Preliminary Plan for New England. Boston, New England Regional Planning Commission, National Resources Board, June 1935, 37 pp. and appendix, illus., diagrs., tables. Present status of surveys and studies necessary in formulation of New England Plan; population; highways; transportation; water resources; conservation and recreation; tentative regional plan; public relations; legislation; program for immediate future. Bibliography.

Streets. Aufgaben des staedtischen Strassenbaus und ihre Loesungen in Berlin, H. Koelzow. *VDI Zeit*, vol. 80, no. 23, June 6, 1936, pp. 714–717. Problems of street construction and their solution in Berlin; influence of traffic development; construction of pavements; solution of problems called forth by traffic conditions; residential street construction.

United States. Regional Planning—Part I, Pacific Northwest. National Resources Committee. Washington, D.C., U. S. Gov. Printing Office, May 1936, 192 pp., maps, diagrs., tables. Price 50 cents. Report on immediate problems in Columbia Basin, particularly as to policies and organization for planning, construction, and operation of public works; recommendations; report of Pacific Northwest Regional Planning Commission; and special staff; conditions, resources, and activities; population; definition of regionality.

CONCRETE

Aggregates. Preparation of High-Specification Sand at Grand Coulee Dam, A. Anable. *Am. Inst. Min. & Met. Engrs.—Tech. Publ.*, no. 715, mtg., Feb. 1936, 15 pp. Description of pit, coarse aggregates, fineness modulus and hypothetic screen analysis, sand-preparation plant, and water recovery and clarification; underflow and overflow characteristics.

Cement, Research. Research on Cement. *Cement & Cement Manufacture*, vol. 9, no. 5, May 1936, pp. 103–107. Abstracts from 1934 report of Building Research Station of Department of Scientific and Industrial Research, giving results of study of system lime-alumina-silica-ferric oxide; hydrated calcium silicates; specification tests for pozzuolanic cement; heat evolution of concrete; fading of concrete products.

Construction, Cold Weather. Winter Concreting Essentials and Possibilities, D. S. MacBride. *Pub. Works*, vol. 67, no. 1, Jan. 1936, pp. 12–14. Summary of essentials illustrated by examples.

Disintegration. Deterioration of Concrete Owing to Chemical Attack, F. M. Lea. *Surveyor*, vol. 89, no. 2312, May 15, 1936, pp. 669–670, (discussion) 673. Effect of sea water, natural moorland waters, ground waters containing sulfate salts, trade wastes, and various oils, fats, and salt solutions to which concrete may become exposed in industry. Before Instn. Sanitary Engrs.

Light Weight. Light-Weight Aggregate Produced from Slate Waste, E. H. Coleman. *Concrete & Constrs. Eng.*, vol. 31, no. 1, Jan. 1936, pp. 47–51. Use of expanded slate as aggregate for light-weight concrete; comparative properties of light-weight concrete; tests on expanded slate concrete.

Piles, Handling. Ingenious Handling of Long, Heavy Piles, H. P. Treadway. *Eng. News-Rec.*, vol. 116, no. 24, June 11, 1936, p. 838. Method of handling reinforced concrete piles 24 in. square, 75 ft long, weighing 23 tons each, by means of traveler derrick in construction of new highway toll bridge crossing Missouri River at South Omaha, Nebr.

Reservoirs. Trinidad Central Water Supply Scheme. *Concrete & Constr. Eng.*, vol. 31, no. 2, Feb. 1936, pp. 115–121. Design and construction of two 3,000,000-gal, covered, concrete reservoirs on island of Trinidad; details of expansion joints.

DAMS

Construction, Materials Handling. Laminated Timber Frames Form Stockpile Tunnels. *Eng. News-Rec.*, vol. 116, no. 26, June 25, 1936, pp. 920–921. Design and construction of three tunnels, from 125 ft to 1,350 ft long, for handling concrete aggregates at Grand Coulee Dam.

Earth, Construction. Wear on Sheepsfoot Rollers, P. Baumann. *Eng. News-Rec.*, vol. 116, no. 24, June 11, 1936, pp. 835–836. Features of extra-diameter rollers used in construction of San Gabriel Dam No. 1, modified to reduce wear in tamping stony earth fill.

Earth, Failure. Overtopping Causes Failure of Elk City Dam. *Eng. News-Rec.*, vol. 116, no. 24, June 11, 1936, pp. 850–851. Failure of earth-fill dam of Elk City, Okla., water supply system of 30-ft maximum height, due to flood discharge of creek equivalent to 680 cu ft per sec per sq mile, or more, from drainage area of 23.5 sq miles.

Hydraulic Fill, Massachusetts. Hydraulic Fill at Quabbin Dike. *Eng. News-Rec.*, vol. 116, no. 25, June 18, 1936, pp. 882–886. Description of contractors plant for placement of 2,000,000 cu yd of embankment for Boston water supply dam 135 ft high, 800 ft wide at base, and 2,140 ft long at crest.

Weirs. Moderno Wehrkonstruktionen, H. Schulze-Manitius. *Werft Reederei Hafen*, vol. 17, no. 3, Feb. 1, 1936, pp. 32–34. Modern types of weirs; illustrated description of different types of segmental and roller weirs.

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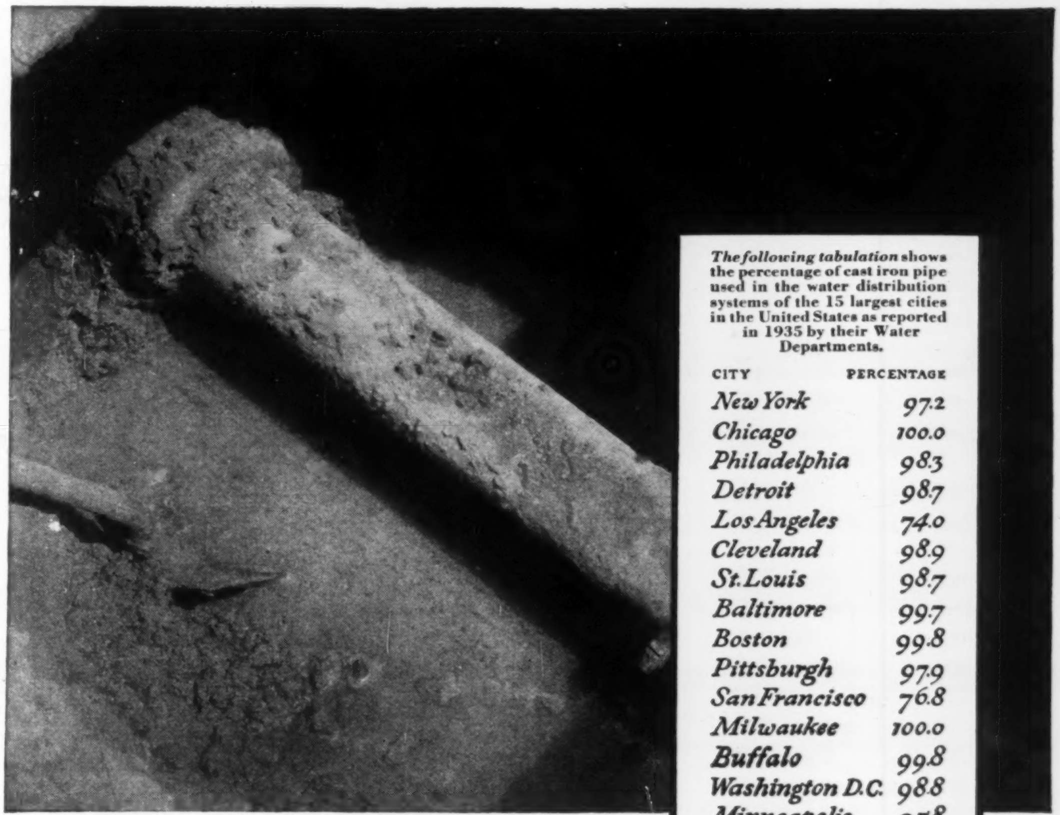

Unretouched photograph of a section of 106-year-old cast iron water main still rendering satisfactory service in Philadelphia's distribution system.

The following tabulation shows the percentage of cast iron pipe used in the water distribution systems of the 15 largest cities in the United States as reported in 1935 by their Water Departments.

CITY	PERCENTAGE
New York	97.2
Chicago	100.0
Philadelphia	98.3
Detroit	98.7
Los Angeles	74.0
Cleveland	98.9
St. Louis	98.7
Baltimore	99.7
Boston	99.8
Pittsburgh	97.9
San Francisco	76.8
Milwaukee	100.0
Buffalo	99.8
Washington D.C.	98.8
Minneapolis	95.8

WATER is free if you go and get it. But if you want it at the turn of a faucet you must pay for the service. Less than the price of a soda for a hundred gallons—a very small cost for an efficient and indispensable public service. One of the reasons why water is cheap is the long life and negligible maintenance cost of cast iron water distribution mains. More than 95% of the pipe which distributes water to the 24 million residents of our 15 largest cities is cast iron pipe.

Cast iron is the standard material for water mains. Its useful life is *more than a century* because of its effective resistance to rust. It is the one ferrous metal pipe for water and gas mains, and for sewer construction, that will not disintegrate from rust. Available in diameters from 1¼ to 84 inches. For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1013 Peoples Gas Building, Chicago, Illinois.

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CIVIL ENGINEER; Jun. Am. Soc. C.E.; college graduate; 10 years practical experience; private license to fly; knowledge of aerial photography and aerial mapping. Desires position either as an engineer or in some phase of aerial mapping. Employed now; available in two weeks. D-2211.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 30; married; B.S. in C.E., Rutgers University, 1930; 2 years as transitman with Essex County Highway Department. Desires opportunity in any branch of civil engineering. Will go anywhere in New Jersey and neighboring states. Available in 15 days. D-663.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 25; single; licensed surveyor, New Jersey; 2 years in surveying (general and precise); 1¹/₂ years in U. S. Department of Agriculture as junior agricultural engineer. Desires opportunity of making a new connection. D-3316.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 28; single; B.S.C.E., Union College, 1929; 6 years engineering experience, including 4 months highway construction and 2¹/₂ years office and field work with large building construction firm; special course in structural welding design; 3 years varied engineering experience, general construction. Desires position in any branch of civil engineering. Available. D-189.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 21; single; B.S. in C.E., Worcester Polytechnic Institute, 1935; 4 months experience with civil engineering firm in Providence, R.I.; 7 months experience as a mechanical engineer. Desires opportunity with some firm engaged in structural design work. Employed now. Available one week after notice of placement. D-5347.

GRADUATE CIVIL ENGINEER; Jun. Am. Soc. C.E.; 26; single; B.C.E., Brooklyn Polytechnic Institute, 1935; 9 months experience in large engineering office; made preliminary designs of heavy reinforced concrete and steel structures; plans for rigid-frame bridges, retaining walls, and building alterations. Desires steady employment in similar field. Available. D-4093.

SANITARY ENGINEER; Jun. Am. Soc. C.E.; 24; single; Christian; B.S. in C.E., Yale University, 1935; M.S. in sanitary engineering, Harvard University, 1936; desires opportunity as sanitary chemist, or in design, plant operation, pollution studies, research, etc.; willing to work hard; excellent recommendations; available immediately. D-5377.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 24; married; B.S. in C.E., Purdue University, 1935. Now employed on project soon to be completed. Desires position that will be permanent and with opportunity for advancement. Location and starting salary secondary. Available in seven days if necessary. D-5381.

MISCELLANEOUS

PATENT ATTORNEY; Assoc. M. Am. Soc. C.E.; registered patent attorney, graduate engineer, and member of bar, desires to make change, preferably by forming connection with a corporation to organize and manage its patent department. Several years experience with outstanding patent law firm; four years experience with corporation patent departments. B-1819.

HYDRAULIC CIVIL ENGINEER; Jun. Am. Soc. C.E.; B.S. (Karlsruhe), C.E. (Paris), and M.S. (Berlin); single; 30; 2 years teaching, hydraulic structures; 4¹/₂ years in construction work, office and field. Experience in flood control, hydroelectric development, power economics, dams, and tunnels. Research in photoelectric silt measurement and anchor-ice formation. Thorough knowledge of Russian, German, and French. D-5237.

TEACHING

ENGINEER: M. Am. Soc. C.E.; S.P.E.E.; M.E. Church; Masonic Lodge; B.S., C.E., and M.S. degrees; registered professional engineer (civil and structural) and surveyor; age 45; 7 years practical experience in various fields; 13 years successful teaching experience (one position); employed at present; desires position teaching civil engineering or applied mechanics, or position with consulting engineer. D-302.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1936. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

AIR CONDITIONING—DESIGN AND CONSTRUCTION OF DUCTS. By T. J. Brett. Chicago, American Technical Society, 1936. 226 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $2.50.

This is a practical text upon the design, construction, and installation of distributing ducts for air-conditioning systems in various types of buildings and railroad cars.

ANALYSIS AND DESIGN OF STEEL STRUCTURES. By A. H. Fuller and F. Kerekes. New York, D. Van Nostrand Co., 1936. 627 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $5.

Planned for use by undergraduates, this book is so arranged that it may be used for an elementary introduction to structures or for advanced courses on bridges and buildings. The material is presented from the point of view of the student who is having his first experience in structural work.

CORROSION RESISTANCE OF METALS AND ALLOYS. (American Chemical Society Monograph No. 71.) By R. J. McKay and R. Worthington. New York, Reinhold Publishing Corp., 1936. 492 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $7.

A general survey of the subject, in which the results of recent studies are summarized under one plan. The first part gives a concise outline of the theory of corrosion. The second part summarizes the useful published data on the corrosion of the various metals and alloys, with critical interpretations. Select bibliographies accompany each chapter.

EARTHQUAKES. By Nicholas Hunter Heck. Princeton, Princeton University Press (London, Humphrey Milford, Oxford University Press), 1936. 222 pp., illus., diagrs., maps, 9 × 6 in., cloth, $3.50.

This book, the August 1936 selection of the Scientific Book Club, presents a broad and comprehensive study of seismology for the general reader, with discussion from every viewpoint. The earthquake is treated both as a tool for the investigation of the interior of the earth and as a menace that must be dealt with. Since the book is not for the specialist, mathematical treatment and highly technical matters have been omitted.

THE EVOLVING HOUSE (Vol. 3, RATIONAL DESIGN). By A. F. Bemis. Cambridge, Mass., Technology Press, 1936. 625 pp., illus., diagrs., charts, tables, 10 × 6 in., cloth, $2.

This is the final volume of an extended study of the evolution of the house. Previous volumes have presented the history of its development and analyzed current housing conditions. The present work attempts an improvement in the physical technique of providing shelter. The author explains the "cubical modular" method of house design, which meets the requirements of mass production, speedy assembly, and efficiency. A long appendix describes the more important efforts to design houses suited to prefabrication.

HOW TO USE PSYCHOLOGY IN BUSINESS. By D. A. Laird. New York and London, McGraw-Hill Book Co., 1936. 378 pp., illus., diagrs., charts, tables, 10 × 6 in., cloth, $4.

This is a thoroughly practical book on industrial psychology, written for the average business man. In everyday language, it discusses a wide variety of problems of personality and suggests methods for handling many situations that arise in business activities.

MANUAL OF PHOTOELASTICITY FOR ENGINEERS. By L. N. G. Filon. Cambridge (England), University Press; New York, Macmillan Co., 1936. 140 pp., illus., diagrs., charts, 8 × 5 in., cloth, $1.50.

The aim of this book is to give "a practical investigator who wishes to use photoelastic methods in order to explore the stress-distributions occurring in any problem in which he is interested, a brief account sufficiently complete and explicit to enable him to set up his apparatus and to use it in the best possible manner."

PRINCIPLES OF STRUCTURAL GEOLOGY, 2 ed. By C. M. Nevin. New York, John Wiley & Sons, 1936. 348 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $3.50.

A simple discussion of the deformations of the earth is presented in this textbook, which is intended for beginning students. Controversial questions are not avoided, and attention is given to possible different interpretations of the evidence. The new edition has been thoroughly revised and a chapter added on structures associated with igneous intrusion.

REINFORCED CONCRETE. By Robert A. Caughey. New York, D. Van Nostrand Company, Inc. (250 Fourth Avenue), 1936. 292 pp., illus., tables, diagrs., charts, 9 × 6 in., cloth, $3.75.

Intended as a guide to the teaching of the mechanics of design of reinforced concrete to advanced students, this volume has been revised to conform to the most recent rules and specifications of reinforced concrete practice. Composite beams of concrete and structural steel are treated, and there is a brief but adequate presentation of the principles of continuity.

THEORY OF ELASTIC STABILITY. By S. Timoshenko. New York and London, McGraw-Hill Book Co., 1936, 518 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $6.

In recent years, much attention has been given to theoretical and practical investigations of the conditions governing the stability of such structural elements as bars, plates, and shells. The results of this work, which have appeared in scattered publications in many languages, have been brought together in this book. The author discusses the bending of prismatic bars under simultaneous axial and lateral loads; the buckling of centrally compressed bars, compressed rings, and curved bars; the lateral buckling of beams; and the bending and buckling of thin plates and shells. The conditions under which stability must be considered are shown, as well as the methods of solution for each type of problem presented.

VDI (Verein deutscher Ingenieure) SONDERHEFT SCHWEISSTECHNIK II. Berlin, VDI-Verlag, 1936. 67 pp., illus., diagrs., charts, tables, 12 × 8 in., paper, 4.50 rm.

This is the second of a series of volumes in which are collected the important papers upon welding which have appeared in the *Zeitschrift des Vereines deutscher Ingenieure.* Twenty-one papers, treating of materials, processes, and testing, are included. The papers give a survey of developments during recent years.

VOCABULARIO TECNICO. By Louis A. Robb. Princeton, N.J., Princeton University Press, 1936. 119 pp., photographs, 9 × 6 in., cloth (free upon application to the Ambursen Dam Company, 295 Madison Avenue, New York, N.Y.).

When this technical vocabulary (Spanish-English and English-Spanish) was originally compiled it was concerned principally with the terminology of hydraulic engineering, but later other branches of civil engineering and general construction work were included. Words or phrases in current use among engineers are included, whether or not their use is sanctioned by any dictionary. In fact it is material not elsewhere available that is emphasized.

WATER PURIFICATION CONTROL, 2 ed. By E. S. Hopkins. Baltimore, Williams & Wilkins Co., 1936. 184 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $1.75.

This is a practical guide for the operator of water purification plants, clearly written, definite, and up to date. The new edition has been thoroughly revised, and a chapter on water softening has been added.

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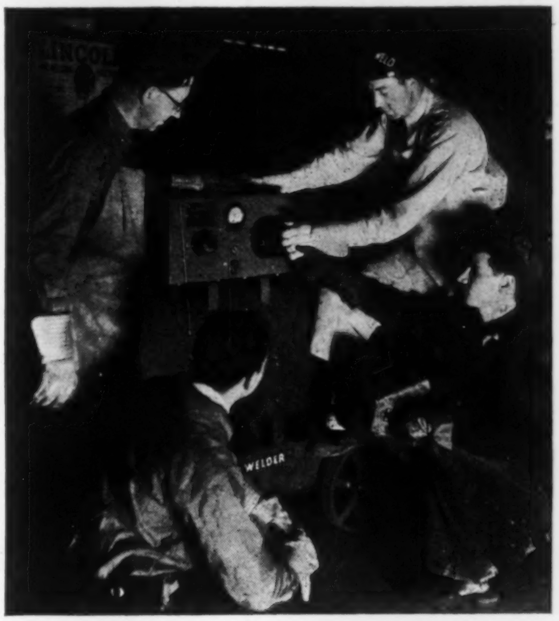

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BRIDGES

Bascule, Floors. Bascule Floor Modernized. *Eng. News-Rec.*, vol. 117, no. 2, July 9, 1936, pp. 56–57. Modernization of Boston Post Road bascule crossing over Poquoneck River, Bridgeport, Conn., by fitting it with durable light floor of ample load capacity and smooth surface; silicon steel, aluminum alloy, and asphalt plank form smooth light-weight floor.

Concrete, Nebraska. Fifty-Six Bridges to Span New Power Canal, J. Nicolet. *Eng. News-Rec.*, vol. 117, no. 6, Aug. 6, 1936, pp. 181–185. Design features of short span bridges over 33-mile power canal of Loup River Public Power District in Nebraska; among them are some concrete rigid frames of special type, one of which has 109-ft span, longest yet used in United States; concrete counterweights; concrete placing; two-span rigid frames; proportioning reinforcing steel; concreting materials; county road bridges; farm bridges; costs.

Steel Arch, Rhodesia. Birchenough Bridge. *Civ. Eng. (London)*, vol. 31, no. 355, Jan. 1936, pp. 9–11. Third longest steel-arch span in world completed over Sabi River in southern Rhodesia; two-hinged, 1,080-ft arch span, with height of 216 ft and width of 45 ft between trusses; two complete systems of lateral bracing used; lightweight chromium steel used throughout; highway deck suspended from arch by steel wire cables.

Suspension, Golden Gate. Tidal Currents of Golden Gate Create Hazard in Fender and Pier Construction, F. W. Crocker. *Western Construction News*, vol. 10, no. 1, Jan. 1935, pp. 2–9. Difficulties encountered in construction of San Francisco pier and fender; methods by which they were overcome; their effect in determining method of construction finally employed.

Swing, Great Britain. Kincardine-on-Forth Road Bridge, S. A. Stewart. *Roy. Engrs.—J.*, vol. 50, June 1936, pp. 223–240, supp. map. Design and construction of multi-span steel bridge over Firth of Forth, Scotland, having total length of 2,696 ft, including swing span, 364 ft long, and number of 100-ft steel girder spans.

Viaducts, Steel. Steel Arch Viaduct Design Governed by Architectural Objectives, J. R. Burkey. *Eng. News-Rec.*, vol. 117, no. 2, July 9, 1935, pp. 37–41. Design and construction of Rocky River steel-arch viaduct at Cleveland, Ohio, consisting of four two-hinged arches flanked by deck girder approach spans; two central arches are symmetrical and measure 256 ft; end arches are unsymmetrical and have span of 236.7 ft; columns without lacing; pier towers made prominent; erecting pier shafts.

BUILDINGS

Oxyacetylene Cutting. Slicing a 13-Story Building, J. C. Carter. *Am. Welding Soc.—J.*, vol. 15, no. 6, June 1936, pp. 10–11. In order to widen street, 13-story, high-class, reinforced-concrete office building was sliced in two by means of oxyacetylene flame; vertical section 5 ft wide removed, and remaining parts of building pushed together and rejoined.

CITY AND REGIONAL PLANNING

United States. Regional Planning. Part II—St. Louis Region. *Nat. Resources Committee—Report*, June 1936, Washington, D.C., 1936, 66 pp., illus., diagrs., charts, maps, tables, 25 cents. Recommendations of National Resources Committee; history and resources of region; organization of region, present and future; principal physical improvements, existing and proposed; program of public improvements; federal and interstate problems; planning administration.

CONCRETE

Disintegration, Causes. Maintaining Concrete Structures, F. W. Capp. *Am. Concrete Inst.—J.*, vol. 7, no. 5, May–June, 1936, pp. 579–592. Analysis of causes of concrete disintegration; occluded water plus low temperature; relation between freezing point of water and pressure under which water exists; corrosion of steel; unanticipated stresses; maintenance methods; concrete for repairs.

Disintegration, Remedies. Concrete Restoration in Water Impounding Structures, J. Lamprecht. *Am. Concrete Inst.—J.*, vol. 7, no. 5, May–June, 1936, pp. 533–569. Causes of and remedies for concrete disintegration; various methods of restoration; plaster method; gravity-placed concrete (reinforced); brush-applied, cement-sand washes; pressure-concrete method; proper base; mesh reinforcement; cracks and joints; construction and end joints; layer thicknesses; surface finish; curing; integral waterproofing; and guaranteed and anticipated results.

Durability. Studying Durability of Concrete, C. H. Scholer. *Am. Concrete Inst.—J.*, vol. 7, no. 5, May–June, 1936, pp. 593–607. Effect of cement on durability; cement in combination with water; influence of aggregate on durability; time, temperature, and water; placing methods; varying exposures; predicting durability.

Reinforcement. Higher Stresses Practicable in Rail-Steel Bars, H. J. Gilkey and G. C. Ernst. *Concrete*, vol. 44, no. 7, July 1936, pp. 11–12. Results of tests conducted at Iowa State College on 22 beams, 3 by 6 by 11 ft, tested under sustained static loading in dry air, after 28 days of moist cooling followed by two or five months in dry laboratory air prior to application of load, to determine facts concerning use of high-elastic limit steel as reinforcement for concrete. Condensed from report of Highway Research Board.

Slabs, Stresses. Distribution of Shearing Stresses in Concrete Floor Slabs Under Concentrated Loads, M. G. Spangler. *Iowa State College—Eng. Experiment Station—Bul.*, 126, Apr. 1936, 52 pp. Experiments of Iowa Engineering Experiment Station, intended to provide basis for determining effective width for maximum shearing stresses in concrete slabs under concentrated loads; data concerning 20 different rectangular slabs, ranging in thickness from $2^{1}/_{2}$ to $6^{1}/_{2}$ in., in width from 5 to $7^{1}/_{2}$ ft, and in span from $3^{1}/_{2}$ to 10 ft; development of empirical working formulas.

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Concrete. Le barrage de Jons sur le Rhone. *Technique Moderne*, vol. 28, no. 12, June 15, 1936, pp. 425–432. Design and construction of open-gate regulator dam over Rhone River at Jons, France, consisting of 5 spans totaling 100.2 m in length, with maximum height from lowest point of foundation equal to 23 m; details of piers and gates; river bank production; method and equipment for operation of gates.

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Hydraulic Structures, Uplift. Simple Tests Determine Hydrostatic Uplift, K. Terzaghi. *Eng. News-Rec.*, vol. 116, no. 25, June 18, 1936, pp. 872–875. Study of hydrostatic uplift in clay and concrete with analysis of simple tests for determining values; manifestations of uplift; floating test; buoyancy compression test; buoyancy expansion and crushing tests.

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Reservoirs, Construction. Construction of Reservoirs in Permanently Frozen Ground, I. A. Shappel. *Vodosnabzheniye i Sanitarnaya Technika*, no. 2, Feb. 1936, pp. 13–16. Model designs of small covered reservoirs excavated in ground underlain with ever-frozen soil. (In Russian with brief English abstract, p. 78.)

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FLOOD CONTROL

Damage, Water Works. Cities Without Water—II, C. H. Kressler and R. W. Foster. *Eng. News-Rec.*, vol. 117, no. 1, July 2, 1936, pp. 15–18. Failure of Harrisburg water works and resulting enlistment of outside aid; precaution against typhoid.

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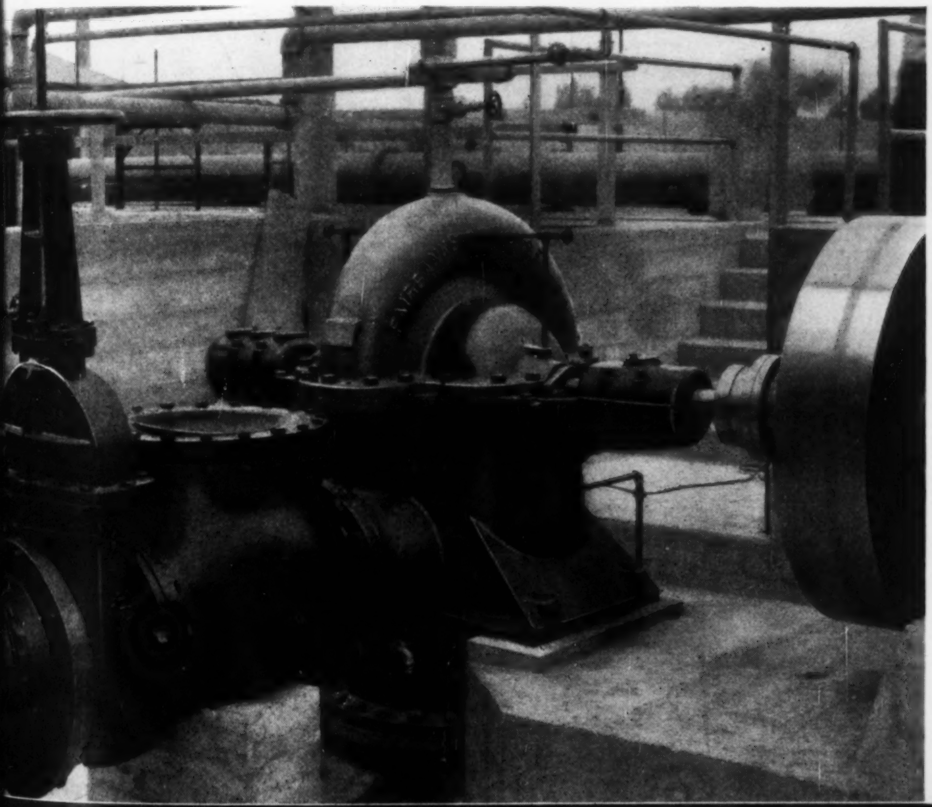

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Discharge. Flood Flow Comparisons. *Eng. News-Rec.*, vol. 116, no. 24, June 11, 1936, p. 836. Tabulated statistical data on peak stages and discharges of floods of March 1936, in New York, Pennsylvania, West Virginia, and New England states.

Forecasting. Long-Range Flood Predictions, C. R. Pettis. *Eng. News-Rec.*, vol. 116, no. 25, June 18, 1936, pp. 870–871. Study of all available flood records, indicating that use of duration curves for long-range predictions may result in error due to change in slope of flood probability line near 100-year point.

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Soil Erosion. Dams Are Not Enough, M. L. Cooke. *Am. Forests*, vol. 42, no. 6, June 1936, pp. 251–253. Prevention of soil erosion as necessary adjunct to flood-control program; silting of flood-detention reservoirs due to soil erosion.

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Meters. Secondary Elements for Water Works and Sewerage Meters, L. D. Carlyon. *Water Works & Sewerage*, vol. 83, no. 5, May 1936, pp. 176–180. Fundamental types of meter devices for registering and recording as applied to measurement of flow of sewage, sludge, air, and water.

Weirs, Discharge. Der heutige Stand der Wehrforschung, F. Engel. *Archiv. fuer Technisches Messen*, vol. 5, no. 53, Nov. 1935, pp. T 141–144 (8 p.), V 1252–1253. Present status of hydraulic research, with regard to weirs and dams; equations for free flow; discharge coefficients; kinds of flow and dimensionless coefficients; flow over crest of dam; various types of dams and weirs; model testing. Bibliography.

FOUNDATIONS

Piles. Actual Bearing Value of Piles. *Civ. Eng.* (*London*), vol. 30, July 1935, pp. 210–211. Tabulation of values for various types of timber and concrete piles driven in different strata. Bibliography.

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LAND RECLAMATION AND DRAINAGE

Reclamation of Land, Portugal. Irrigation, Drainage, and Flood Protection Works in Portugal, R. Mayer. *Engineer*, vol. 161, no. 4195, June 5, 1936, pp. 590–592. Brief description of schemes for which plans have been prepared.

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Bridges, Steel Arch. Tests of Steel Chord Members for Bayonne Bridge, A. H. Stang, H. L. Whittemore, and L. R. Sweetman. *U. S. Bur. Standards—J. Research*, vol. 16, no. 6 (RP897), June 1936, pp. 627–637, 3 supp. plates. Investigation of strength and other properties of lower-chord members for Kill van Kull steel-arch bridge, which crosses from Port Richmond, S. I., to Bayonne, N.J.; these members, of carbon-manganese steel, are of double-box type, having diaphragms and continuous walls.

Columns, Steel. Tests of Eight Large H-Shaped Columns Fabricated from Carbon-Manganese Steel, A. H. Stang, H. L. Whittemore, and L. R. Sweetman. *U. S. Bur. Standards—J. Research*, vol. 16, no. 6 (RP896), June 1936, pp. 595–626. Investigation carried out by bridge department of Port of New York Authority and U. S. Bureau of Standards, with reference to strength and behavior under load of large H-shaped columns fabricated from plates and angles and material representative of those which went into building of Bayonne arch bridge.

Concrete. Permeability and Durability of Concrete, R. H. Evans. *Surveyor*, vol. 89, no. 2318, June 26, 1936, pp. 877–878. Practical importance of permeability and durability of plain and reinforced concrete; principal reasons for making permeability tests; reduction of permeability; durability under chemical attack; water-retaining structures; vibrated concrete. Before Brit. Water Works Assn.

Concrete, Durability. Alternate Heating and Cooling of Mortar, E. R. Dawley. *Am. Concrete Inst.—J.*, vol. 7, no. 5, May–June 1936, pp. 609–620. Results of experimental study made at Engineering Experiment Station of Kansas State College on effect of alternate heating and cooling on strength of river sand and crushed rock concrete; change in length and weight of samples.

Concrete, Workability. Factors of Workability of Portland Cement Concrete, W. H. Herschel and E. A. Pisapia. *Am. Concrete Inst.—J.*, vol. 7, no. 5, May–June, 1936, pp. 641–658. Review of test methods designed to measure workability of concrete; harshness, segregation, shear resistance, and stickiness; application of tests to concrete made from various cementitious materials. Bibliography.

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Quay Walls, Bordeaux, France. Erneuerung von Kaianlagen in Bordeaux, Bolle. *Werft-Reederei-Hafen*, vol. 17, no. 5, Mar. 1, 1936, pp. 58–59. Renewal of quay walls in port of Bordeaux; brief illustrated description.

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ROADS AND STREETS

Antiquity. When All Roads Led to Rome, W. S. Powell. *Compressed Air Mag.*, vol. 41, no. 6, June 1936, pp. 5051–5054. Brief history of road building from time of early Egyptian, Babylonian, and Carthaginian civilizations to Elizabethan period, with design details of ancient Roman roads and masonry bridges.

Bituminous. Maintenance of Bituminous Surfaces and Shoulders in Connecticut, J. C. Black. *Roads and Streets*, vol. 79, no. 5, May 1936, pp. 29–32. System used by Connecticut State Highway Department for reducing maintenance costs by light bituminous treatment of shoulders semi-annually.

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Drainage. Draining Wet Subgrades Under Existing Pavements, B. H. Petty. *Roads & Streets*, vol. 79, no. 3, Mar. 1936, pp. 31–32. Statement of problem with plea that highway engineers submit for publication manuscripts setting forth experiences and methods used to solve this problem.

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Maintenance and Repair. Survey of County Road Conditions Before Resurfacing, G. Gault. *Roads & Streets*, vol. 79, no. 5, May 1936, pp. 54, 56, and 58. Importance of preliminary survey to determine whether any changes in alignment or grade should be made, or any additional right of way is necessary; general drainage of right of way; condition of all drainage structures; character of subgrade and present surface. Before 22d Annual Purdue Road School.

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Salt Stabilization. Maintenance Methods for Stabilized Roads, R. H. Reid. *Eng. & Contract Rec.*, vol. 50, no. 24, June 10, 1936, pp. 515–518. Details of procedure to keep calcium-chloride-treated gravel roads in proper condition.

Snow Control. Fighting Snowdrifts, C. E. Learned. *Eng. News-Rec.*, vol. 117, no. 1, July 2, 1936, pp. 6–9. Snow removal and control practices of U. S. Bureau of Public Roads on highways of Continental Divide, where annual snowfall may be from 300 to 600 ft.

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SEWERAGE AND SEWAGE DISPOSAL

Activated Sludge. Improving Efficiency of Activated Sludge, H. C. Whitehead and F. R. O'Shaughnessy. *Surveyor*, vol. 89, no. 2303, Mar. 13, 1936, pp. 407–410. Purposes and possible applications of activated sludge process; review of recent investigations; authors' conclusions. Bibliography.

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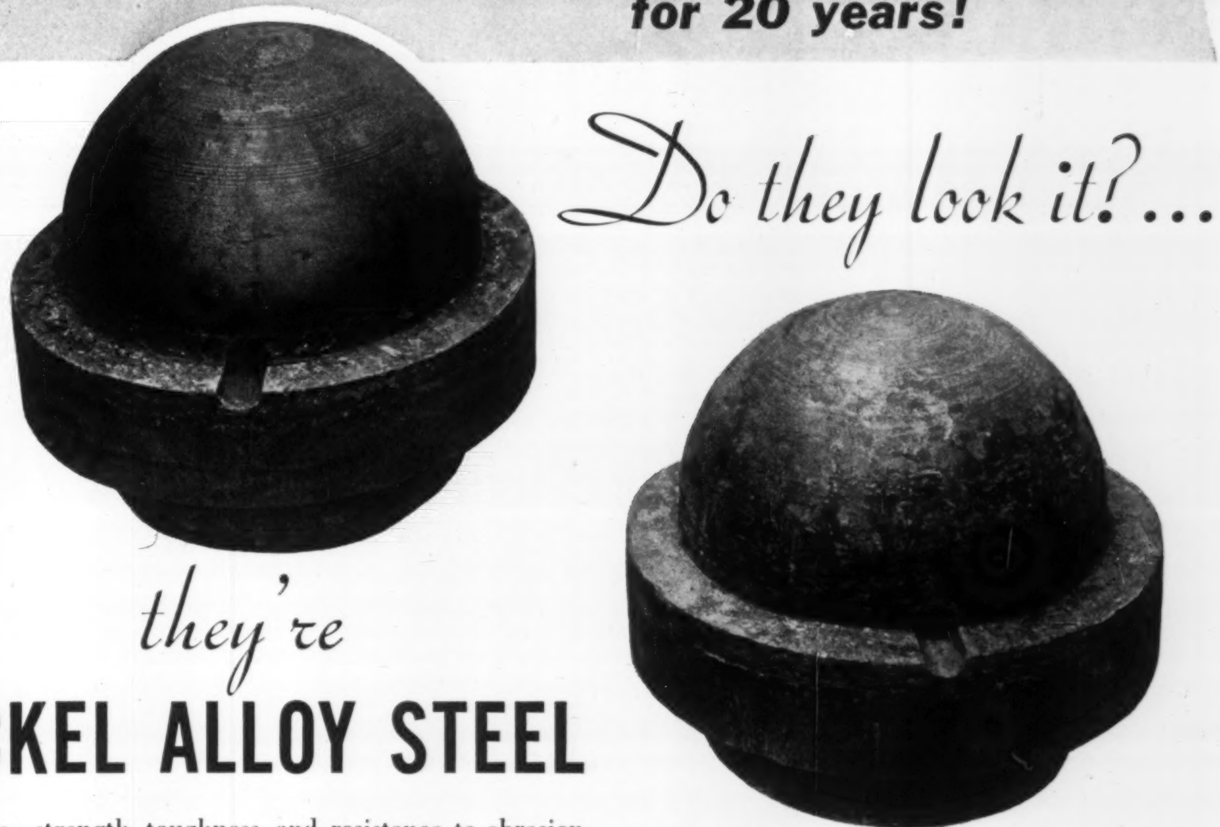

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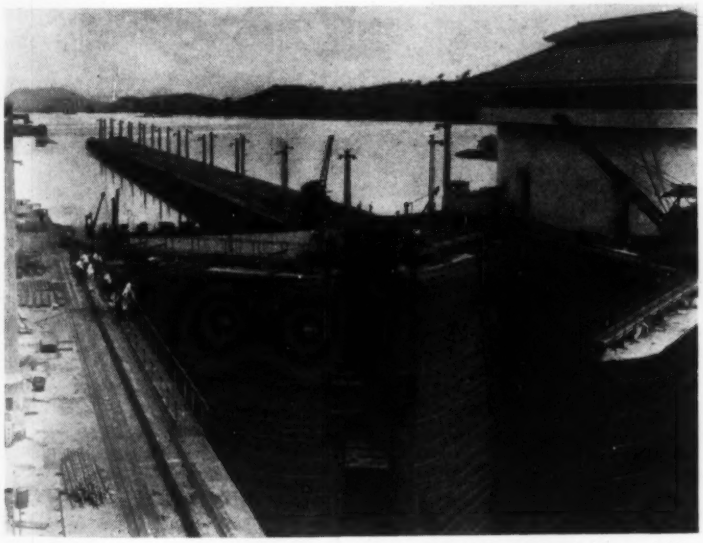

General view of the overhauling work at Pedro Miguel Dock, Panama Canal, done in 1935.

• • •

This Panama Canal job gave other eloquent testimony to the endurance of steel alloyed with Nickel. After more than 25 years, some of the vertical bearing plates were replaced. The original specification, made in 1911, called for "not less than 3.25% Nickel." Uncle Sam's engineers were so well satisfied with their work that the new specification (A. S. T. M. A-8-29) is almost identical.

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ACTIVATED SLUDGE, INVESTIGATION. Digestion of Activated Sludge, E. Ardern and W. T. Lockett. *Surveyor*, vol. 88, no. 2270, July 26, 1935, pp. 89–90. Investigation at Manchester, England, to ascertain minimum digestion period required for satisfactory maintenance of fermentation process when yielding digested sludge which could be dealt with on land without fear of aerial nuisance. Before Inst. Sewage Purification.

ANALYSIS. Strength of Sewage, M. Lovett and J. H. Garner. *Surveyor*, vol. 88, no. 2288, Nov. 29, 1935, pp. 601–603. Comparison of number of analytical methods that have been applied either directly or indirectly (through formulas) to determinations of strength of sewage liquids. Before Inst. Sewage Purification.

CHEMICAL PROCESS. Chemical Coagulation of Sewage. III—Effect of Pre-Settling, W. Rudolfs and H. W. Gehm. *Sewage Works J.*, vol. 8, no. 3, May 1936, pp. 422–429. Effect of varying amounts of ferric chloride on clarification; effect of coagulation time on turbidity removal; effect of suspended solids concentration on clarification in acid range and in optimum alkaline range of coagulation. Bibliography.

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CHEMICAL PROCESS, LITERATURE. Developments in Chemical Treatment of Sewage, A. M. Buswell and J. G. Burtle. *Can. Engr.*, vol. 70, nos. 13 and 21, Mar. 31, 1936, pp. 11–12, and 14, and May 26, pp. 10–12. Review of literature dealing with chemical precipitation, activated sludge process, and methods of chlorination. Bibliography.

NEW METHODS. Some Recent Developments in Sewage Purification, J. H. Garner and M. Lovett. *Surveyor*, vol. 89, No. 2296, Jan. 24, 1936, pp. 109–111. Activated carbon in sewage treatment; comminution of sewage screenings; treatment of milk factory effluent; bulking of activated sludge; measurement of odor. Before Inst. Sewage Purification.

PLANT, DESIGN. Factors in Design of Sewage Disposal Works, H. C. Whitehead and F. R. O'Shaughnessy. *Surveyor*, vol. 88, nos. 2282, and 2283, Oct. 18, pp. 403–407, and Oct. 25, 1935, pp. 433–440. Effect of recent developments in methods of treatment upon design of plant.

PLANTS, SOUTH AFRICA. Design and Operation of Sewage Disposal Works in South Africa, E. J. Hamlin. *Surveyor*, vol. 89, no. 2308, Apr. 17, 1936, pp. 561–562. Before Roy. Sanitary Inst.

REFUSE, GRINDING. Effect of Ground Garbage on Sewage Treatment Plant Operation, C. K. Calvert and S. L. Tolman. *Water Works & Sewerage*, vol. 83, no. 5, May 1936, pp. 161–167, (discussion), 167–168. Results of seven months' experience with garbage grinding plant at Indianapolis, Ind., indicating that ground garbage offers no serious problem in sewage treatment and that such disposition appears to be more economical than methods now in use.

WATER PIPE LINES

CROSS-CONNECTIONS. Serving Disease to Consumers Via Pipes and Fixtures, J. I. Connolly. *Water Works Eng.*, vol. 89, no. 11, May 27, 1936, pp. 631–635. Protection of safety of drinking water supplies against menace of cross-connections; problems of high buildings; danger from partial vacuum in pipes.

LOCATION RECORDS. Location Records of Mains and Services, W. K. van Zandt. *Am. Water Works Assn.—J.*, vol. 28, no. 6, June 1936, pp. 738–740. Suggestions of maintenance of pipe-line location; records for cities having population of 100,000 or more.

WATER RESOURCES

UNITED STATES, COMMITTEE. Activities and Aims of Water Resources Committee. *Eng. News-Rec.*, vol. 117, no. 2, July 9, 1936, pp. 42–43. Establishment of Water Resources Committee of National Resources Committee; federal interests in water uses; obtaining basic data; coordination of conflicting interests; water pollution reviewed; balanced river regulation; special assignments; tentative future program.

UNITED STATES, PLANNING. Conserving our National Water Resources, F. R. Shaw. *Am. Water Works Assn.—J.*, vol. 28, no. 6, June 1936, pp. 757–769. Planning of utilization of water resources of United States; reports of National Resources Committee; public water supplies; appraisal of stream pollution; control progress; weighted average hardness of water furnished in 1932 by public supply systems.

WATER TREATMENT

CHLORINATION. Results of Chloramine Treatment in Duluth, Minn., Water Supply, D. L. Johnson. *Water Works Eng.*, vol. 88, no. 19, Sept. 18, 1935, pp. 1061 and 1096. System successfully used in reduction of tastes caused by algae growths in Lake Superior. Before Am. Water Works Assn.

CHLORINATION, AMMONIA-CHLORINE. Chloramines Simplify Sterilization of Asheville Water, W. Parks, Jr. *Water Works Eng.*, vol. 89, no. 10, May 13, 1936, pp. 536–539. Operating results of ammonia-chlorine treatment at Bee Tree and North Fork plants at Asheville, N. C.

CONTROL. Laboratory Control, C. R. Cox. *Water Works Eng.*, vol. 89, nos. 6, 7, 8, and 9, March 18, 1936, pp. 315–317; April 1, pp. 364–366; April 15, pp. 437–438; and April 29, pp. 488–490. March 18: Orthotolidine test for residual chlorine. April 1: Determination of free ammonia by direct Neselerization. April 15: Mineral constituents of water and their relation to treatment of water. April 29: Determination of alkalinity.

FILTRATION PLANTS, DENVER, COLO. Design Features of Denver's Newest Filtration Plant, L. R. Howson. *Eng. News-Rec.*, vol. 117, no. 3, July 16, 1936, pp. 78–80. Description of fifth Denver filter plant consisting of 10 units, each having capacity of 5.6 mgd when operating at rate of 2.8 gal per min per sq ft; soft water from melting snows on West Slope will be brought through Moffat Tunnel; details of layout of combined flocculating and sedimentation basin, showing paddle wheel mechanism and wood baffles; storage provided for wash water.

FILTRATION PLANTS, DESIGN. Filter Design as Related to Operation, H. N. Jenks. *Can. Engr.*, vol. 70, no. 25, June 23, 1936, pp. 9–12. Trend toward simplification in filter design and operation. Before Am. Water Works Assn.

FILTRATION PLANTS, HAMILTON, ONT. Plant Meets Variable Conditions in Treating Lake Water, W. L. McFaul. *Water Works Eng.*, vol. 88, no. 8, Apr. 17, 1935, pp. 375–378. Design features of plant for Hamilton, Ont., to treat Lake Ontario water, with four pumps with capacity of 5½, 11, 22, and 33 mgd, respectively. Before Canadian section of Am. Water Works Assn.

FILTRATION PLANTS, LEXINGTON, VA. Novel Gravity Filter Plant, W. M. Johnson. *Water Works & Sewerage*, vol. 83, no. 5, May 1936, pp. 143–147. Design features of elevated 5-story plant with capacity of 800,000 gal per day.

NEW ENGLAND. Water Purification in New England, E. S. Chase. *Water Works Eng.*, vol. 88, no. 19, Sept. 18, 1935, pp. 1056–1058. Review of present practices.

NEW METHODS. New Developments and Trends in Water Treatment, F. M. Dawson *Water Works Eng.*, vol. 89, no. 11, May 27, 1936, pp. 683–684, 687–688, and 691. Topics reviewed are as follows: Better water demanded; taste and odor control; fluorine in water; treatment to destroy algae; ferric chloride as coagulant; corrosion prevention; removal of iron and other materials; clay to aid coagulation; water-borne epidemics; contamination of water in distribution systems; elimination of cross-connections.

PITTSBURGH, PA. Experiences with Treatment of Monongahela River Water, F. W. Bouson. *Am. Water Works Assn.—J.*, vol. 28, no. 6, June 1936, pp. 748–756. Experience of South Pittsburgh Water Company, with treatment of raw water from Monongahela River; industrial water treatment; carbonization; maintenance of filters; natural coagulants; taste and odor.

PLANTS, BOULDER CITY, NEV. Treatment of Colorado River Water, D. M. Forester. *Am. Water Works Assn.—J.*, vol. 28, no. 5, May 1936, pp. 627–639. Description of Boulder City, Nev., plant, designed for maximum capacity of 2 mgd to treat water averaging 210 ppm non-carbonate and 158 ppm carbonate hardness; variations in treatment; quality of water after storage.

PLANTS, CHLORINE HANDLING. Some Practical Aspects of Handling Chlorine, C. F. Bingham. *Water Works & Sewerage*, vol. 83, no. 2, Feb. 1936, pp. 37–41. Experiences in safe handling; properties of chlorine; materials for chlorine lines; avoiding condensation troubles; container temperatures and pressures; handling containers; ventilation facilities and leak handling. Before Am. Water Works Assn.

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SWIMMING POOLS. Treatment of Swimming Pool Water to Insure Purity of Supply, R. F. Heath. *Water Works Eng.*, vol. 89, no. 13, June 24, 1936, pp. 855–856 and 859. Methods to remove or modify pollution; proper rate of filtration; use of chlorine in treatment; odor and algae control; cross-connections to be avoided.

WATER WORKS ENGINEERING

COLD WEATHER OPERATION. Frost Difficulties and Experiences during Past Winter at Wilmington, W. C. Wills. *Am. Water Works Assn.—J.*, vol. 28, no. 7, July 1936, pp. 837–840. Difficulties of Water Department of Wilmington, Del., with winter operation of services, meters, fire hydrants, and treatment plant.

DESIGN AND OPERATION. Recent Trends in Water Works Design and Operation, L. R. Howson. *Water Works Eng.*, vol. 89, no. 8, Apr. 15, 1936, pp. 428–432. Progress with respect to chemical feeding and handling equipment; mixing facilities; washing of filters; controlling tastes and odors; water works administration; financing construction from earnings; systematic testing of meters; importance of good architecture. Before Am. Water Works Assn.

DISTRIBUTION SYSTEMS, CONNECTICUT. Private Water Company Reviews Its Problems, E. E. Minor. *Water Works Eng.*, vol. 89, no. 14, July 8, 1936, pp. 889–892. Distribution system comprising 600 miles of pipe of New Haven Water Company described; method used to carry lines over railroad tracks and streams; changes in intake practice; surveys to locate leaks; hazards of cross-connections; importance of electrolysis control. Before New England Water Works Assn.

FIRE PREVENTION. Better Fire Protection for Smaller Communities, C. Goldsmith and G. Tatnall. *Am. Water Works Assn.—J.*, vol. 28, no. 6, June 1936, pp. 699–708. Review of fire protection provisions for communities having population of about 2,000, also for cities with larger population; storage; better pumping facilities; improvement in distribution system; additional necessities; fire hydrants.

FLOODS, EFFECT. Effect of Spring Thaws on Operating Conditions. *Water Works Eng.*, vol. 89, no. 8, Apr. 15, 1936, pp. 448 and 451. Discussion by water works superintendents of additional treatments or chemical application required as result of spring flood.

JAPAN. Tokyo Water-Works, T. Iwasaki. *Am. Water Works Assn.—J.*, vol. 28, no. 6, June 1936, pp. 720–729. History of water works of capital of Japan supplying 250 mgd; water treatment processes, including results of various laboratory tests in tabular forms.

LANDSCAPE ARCHITECTURE. Aesthetic Enters Water Field, S. A. Evans, Jr. *Water Works Eng.*, vol. 89, no. 11, May 27, 1936, pp. 626–630. Landscaping by Bureau of Water Works and Supply, Los Angeles, Calif., of grounds around 17 reservoirs, 19 tanks, and 10 buildings.

MANAGEMENT. Reorganizing Water Utility for More Efficient Service. *Eng. News-Rec.*, vol. 117, no. 1, July 2, 1936, pp. 13–14. Reorganization of Denver municipal water works department, which included revamping of basic managerial functions, introduction of budgetary control, and utilization of more efficient office procedure.

NEW YORK. Water Works Construction in New York State with Federal Aid, E. Devendorf. *Am. Water Works Assn.—J.*, vol. 28, no. 3, Mar. 1936, pp. 330–341. Review of accomplishments in water works sanitation projects under PWA; cost of projects undertaken by TERA in New York State and man-days of work performed Nov, 1, 1931, to Nov. 20, 1933; expenditures under CWA, Nov. 20, 1933, to Mar. 31, 1934; reservoir improvements; watershed improvements.

OPERATION, AUTOMATIC. Minimizing Human Element in Water Works Operation, N. S. Hill, Jr. *Water Works Eng.*, vol. 89, no. 11, May 27, 1936, pp. 664, 667–668 and 671–672. Reduction of costs and elimination of failure by use of automatic operation and control.

OPERATION, NEW METHODS. Some New Operating Practices Followed by Water Departments, F. E. Stuart. *Water Works Eng.*, vol. 89, no. 8, Apr. 15, 1936, pp. 456 and 459. Plans adopted by water works superintendents to increase flexibility and efficiency of their systems.

RECENT PROGRESS. Progress in Water Supply and Treatment During 1935, L. V. Carpenter. *Water Works & Sewerage*, vol. 83, no. 1, Jan. 1936, pp. 1–8. Elevated storage and beautification; studies of pipe depreciation; national water planning; air conditioning and consumption; anthracite as filter media; filter washing; taste and odor control; corrosion control.

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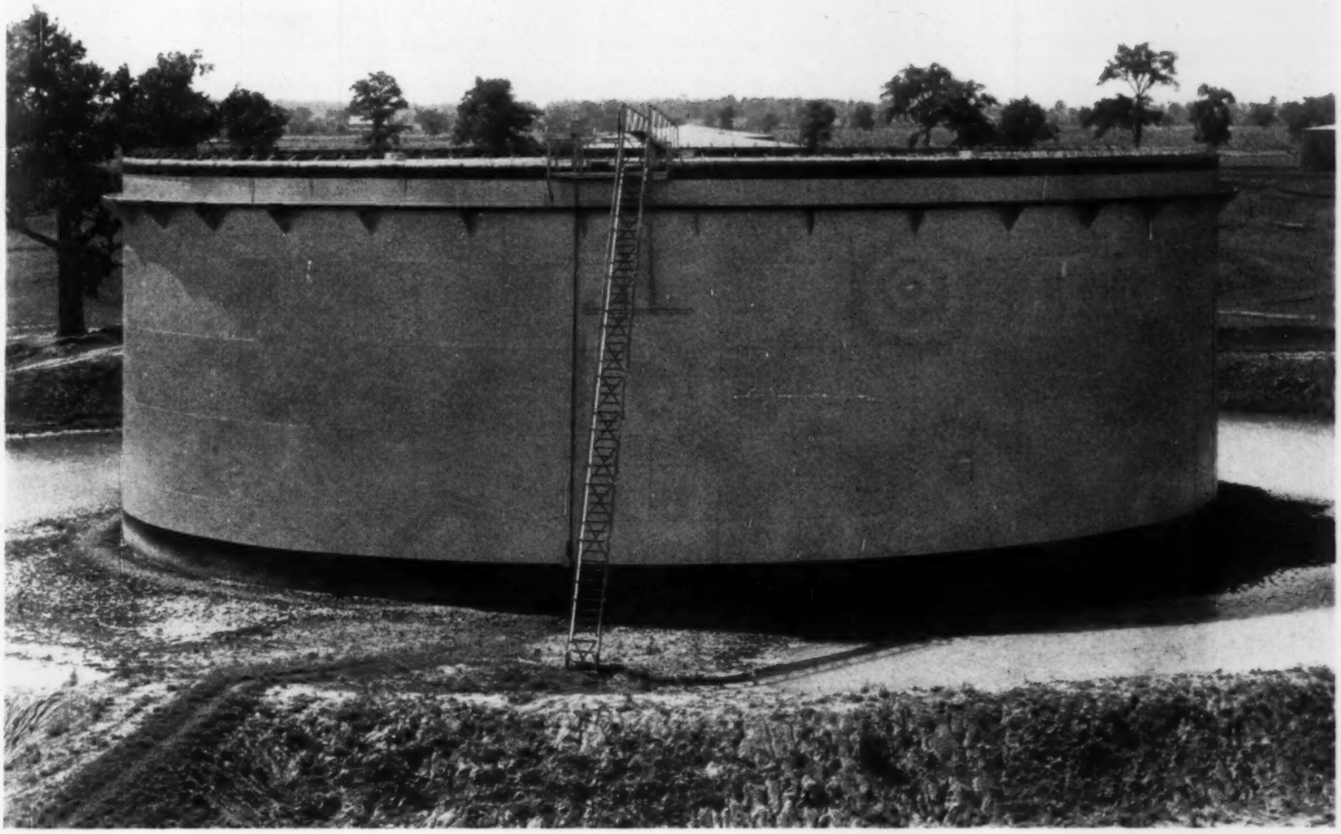

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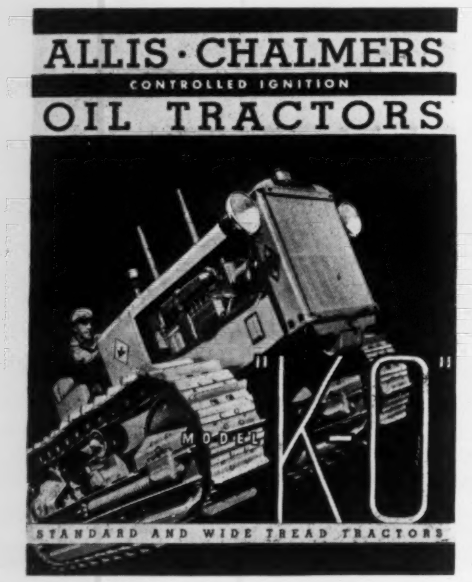
Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

Diesel Fuel Tractors

"Model 'KO' Standard and Wide Tread Tractors" is the title of an attractive new 32-page catalog issued by Allis-Chalmers Manufacturing Company, Milwaukee. The catalog contains complete information on the new Model "KO" Diesel fuel tractor recently announced by Allis-Chalmers.



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Features and improvements on the "KO" are described and illustrated in an interesting manner. The principles of the controlled ignition engine, which has won widespread attention, are explained in clear, concise form and several pages are devoted to the simple, new injection system developed by Allis-Chalmers. Fuel and lubricating systems are illustrated with cross-section views in color and important features of construction of the "KO" tractor are described.

Copies of the catalog can be secured by writing to the Company at Milwaukee.

Truckair Compressor

The Sullivan Machinery Company, Michigan City, Ind., announce a new compressor unit designed specifically for truck mounting with power take-off from the truck propeller shaft to utilize the truck engine for drive. The compressor is two stage air-cooled with capacity of 105 C.F.M. delivered—enough to operate a large rock drill or two pavement breakers.

Features stressed are force feed lubrication, anti-friction main bearings, automatic control and small space requirements described in Bulletin A-14.

New 12-Yd Carryall Scraper

A new model 12 yd Carryall Scraper, the Type "Y," for use with RD-8 Caterpillar tractors, has just been announced by R. G. LeTourneau, Inc., Peoria, Illinois, and Stockton, California.

In design the new model is quite similar to the Company's former 12-yd Carryall. It is cable controlled by means of a two-drum LeTourneau Power Control Unit mounted at the rear of the pulling tractor. It embodies the same positive, accurate unloading method, namely, use of a sliding tailgate to force material out of the bowl. The cutting blade of 10 ft in width, bowl dimensions, and dirt-carrying capacity are the same.

The major change is in the tire size, which has been increased from 13.50 by 20 to 18.00 by 24. The larger tires greatly reduce draft on the tractor and provide a much larger ground contact, so the new Carryall will stay on top of soft mud and fine sand where smaller tired rigs bog down. Four low-pressure tires are standard equipment on the Type "Y," but duals on the rear and singles in the front, or duals both front and rear, are optional at extra cost.

As with former LeTourneau 12-yd models, the Type "Y" can be operated in tandem behind a single tractor equipped with a four-drum Power Control Unit. The rear drawbar for tandem hookup is standard equipment.

Jeffrey Double-Roll Crusher

The Jeffrey Manufacturing Co. of Columbus, Ohio, has developed a new design of double-roll crusher. The chief feature of this machine is a self-contained endless belt drive between the rolls which allows quick adjustment of the rolls within the limits of the sizing range while the machine is running. The crusher is also provided with an all-steel frame having heavy steel cross-ties.

Wire Rope Fittings

A new line of fittings for wire ropes and cables is announced by the Electroline Company, 4121 La Salle St., Chicago, Ill.

Wire ropes and strands are held in these fittings by means of a tapered metal plug enclosed in a steel body. The fittings are manufactured in many forms, and are made of 1040 S.A.E. steel, drop forged, heat treated, and machined to precise dimensions for use with all sizes of wire ropes from $^1/_4$ in. to 1 in. diameters. According to the manufacturer, these fittings give 100% cable strength.

New P & H $^3/_4$ Yd Excavator

Broadening the line of P & H Pacemakers, the Harnischfeger Corporation of Milwaukee announces a new high-speed, $^3/_4$ yd machine, Model 355. Designed as an all-purpose machine, the 355 is built of the new high-tensile steels by electric welding, thereby effecting a considerable weight reduction.

For the first time on any $^3/_4$ yd excavator, the P & H Model 355 uses standard tractor crawlers of the type manufactured by the Allis-Chalmers Company. All movements in travel and digging have two-speed transmission with a high-speed direct drive.

Model 355 has an all welded dipper made of rolled steel, with $^3/_4$ yd struck measure capacity. The removable dipper teeth, of full manganese steel, are reversible. The machine also is available with light alloy steel attachments for service as shovel, dragline, crane, skimmer scoop, trench hoe, and pile driver. An illustrated, 12-page catalog will be forwarded upon application.

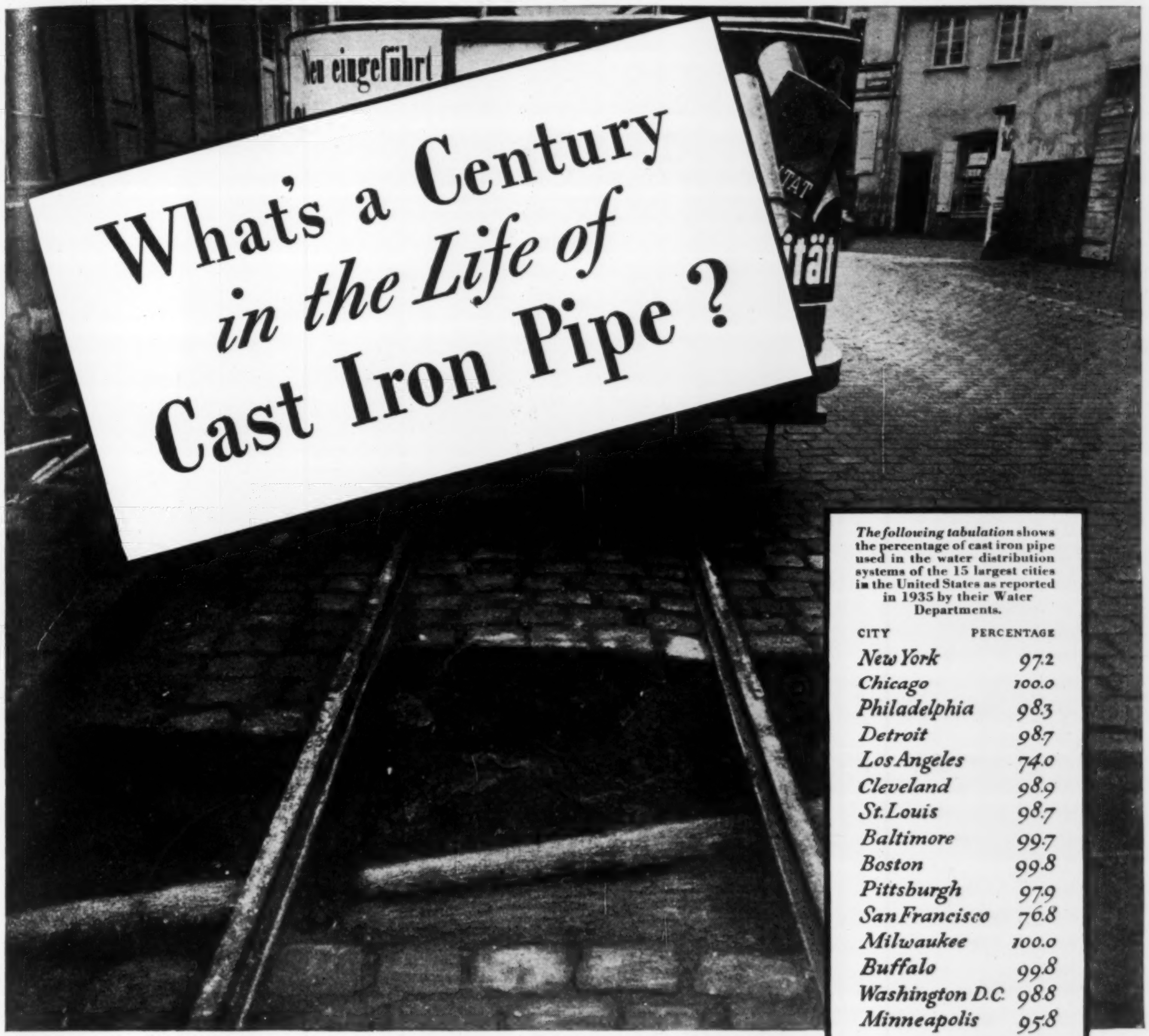
Type S Diesel

Ingersoll-Rand Company, 11 Broadway, New York, N.Y., recently announced its Type S Diesel Engine. This engine is an improved design which is thoroughly modern in all respects. It is of the vertical, four-cycle, single-acting, solid-injection type designed to run at medium speeds and built for heavy-duty, continuous service.

The fundamental design is similar to that of the successful Ingersoll-Rand locomotive engine of which there are more than 140 in operation. Some of these have been in service for over 12 years.

Type S engines are made with 3, 4, 5, 6, and 8 cylinders for ratings from 150 to 460 horsepower.

A new 24-page bulletin describing these engines has just been issued. It may be obtained from any Ingersoll-Rand branch office.



What's a Century *in the Life of* Cast Iron Pipe?

The following tabulation shows the percentage of cast iron pipe used in the water distribution systems of the 15 largest cities in the United States as reported in 1935 by their Water Departments.

CITY	PERCENTAGE
New York	97.2
Chicago	100.0
Philadelphia	98.3
Detroit	98.7
Los Angeles	74.0
Cleveland	98.9
St. Louis	98.7
Baltimore	99.7
Boston	99.8
Pittsburgh	97.9
San Francisco	76.8
Milwaukee	100.0
Buffalo	99.8
Washington D.C.	98.8
Minneapolis	95.8

This 210-year-old cast iron water main at Ehrenbrietstein, Germany, is still in service and good condition. (Photograph by courtesy of Deutscher Gussrohr Verband G. m. b. H., Cologne.)

In OLDER cities abroad it is not uncommon to find cast iron water mains that have been rendering satisfactory service for from one to two centuries and longer. Many American cities have cast iron pipe in their distribution systems that has been serving for more than a century. Time has yet to reveal the full span of the useful life of cast iron pipe. That it serves longest and costs least per service year and least to maintain, are recorded facts and the reason for its almost exclusive use in the distribution systems of our 15 largest cities. Cast iron is the standard material for water mains. Its useful life is *more than a century* because of its effective resistance to rust. It is the one ferrous metal pipe for water and gas mains, and for sewer construction, that will not disintegrate from rust. Available in diameters from 1¼ to 84 inches. For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1013 Peoples Gas Building, Chicago, Illinois.

CAST IRON PIPE

METHODS OF EVALUATING BIDS NOW IN USE BY ENGINEERS RATE THE USEFUL LIFE OF CAST IRON PIPE AT 100 YEARS

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Civil Engineer; Assoc. M. Am. Soc. C.E.; 35; married; 9 years as construction engineer with state highway department; 3 years general engineering in West Indies and Central America. Speaks Spanish. Desires connection promising some degree of permanence in construction, planning, or location. D-5424.

Construction Engineer; Assoc. M. Am. Soc. C.E.; 39; graduate civil engineer; registered professional engineer, state of Pennsylvania; 13 years experience, including railroad maintenance, dredging, many types of heavy concrete and steel construction, land surveying, and over 6 years on two of the largest suspension bridges. Available immediately. D-5277.

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Bridge Designer; Assoc. M. Am. Soc. C.E.; university graduate; 35 years old; 12 years experience with fabricating company on large bridges and highway bridge design. Location immaterial; will consider foreign countries. Employed; available on 2 weeks' notice. D-5462.

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Municipal or Highway Engineer and City Manager; Assoc. M. Am. Soc. C.E.; age 43; married; graduate civil engineer; Michigan registration; capable administrator and executive; 8 years city engineer; 6 years highway engineer; 8 years city manager. Available immediately. A-1941.

Civil Engineer; Jun. Am. Soc. C.E.; 30; single; graduate; trained at Purdue University and Polytechnic Institute of Brooklyn; 2 years in charge of development of hundred-acre park; experience also; engineering assistant; inspector of highways; in charge of personnel. Now engaged as inspector of dredging operations. Desires to enter city planning field. Holds commission as captain, Officers Reserve Corps. Location immaterial. D-2304.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 47; married; graduate, University of Wisconsin. Experienced in oil-refinery construction and maintenance, machine design, highways, sewerage, water supply, investigation, and surveys. Held positions of chief of party, chief draftsman, estimator, designer, and resident engineer; 9 years with one company. Now employed; available on notice of month or less. A-3318.

Civil Engineer; Assoc. M. Am. Soc. C.E.; graduate civil engineer; age 46; married; 24 years experience, city planning transportation studies, traffic research field surveys, industrial buildings and plant layout, mechanical installations and maintenance of equipment. Now available. Location immaterial. C-7958.

Administrative, Industrial Executive; M. Am. Soc. C.E.; employed—seeks association offering advantages; equivalent of 20 years experience, directing building design, specifications, securing bids, letting contracts, maintenance and construction supervision. Large and small projects throughout Eastern seaboard applying to industrial plants, commercial buildings, and housing. Licensed architect and engineer. Record will permit most critical investigation. B-8117.

Engineer; Assoc. M. Am. Soc. C.E.; graduate; New York state license; 34; married; 13 years experience in field of municipal water works; analysis, design, maintenance; operation. Fluent French and Spanish; some German. Capable of handling men. Available on reasonable notice. D-5451.

Civil Engineer; M. Am. Soc. C.E.; graduate; married; 10 years varied experience, drainage surveys, railroad construction, design of structures, mass transportation studies, extensive valuation; 20 years with property, as engineer on maintenance of way and structures, directing entire office and construction forces, including large railway rehabilitation program. Central states preferred. Available immediately. A-1864.

Junior

Construction Engineer and Superintendent; Jun. Am. Soc. C.E.; 27; married; graduate civil engineer; 1 year teaching civil engineering; 2 years state engineer and inspector on construction of highways and highway bridges; 4 years superintendent on construction of highway bridges and grade-crossing eliminations. Available on short notice. C-7777.

Civil Engineer; Jun. Am. Soc. C.E.; 22; B.S.C.E., New York University, 1934; 5 months as rodman and transitman with New York City Department of Parks on topographical and construction surveys; 5 months as surveyman, U. S. Engineers, New York–Pennsylvania flood-control survey; 2½ months line, grade, construction of concrete bleachers, Yankee Stadium, New York. Desires civil engineering position. Location immaterial. Available. D-4300.

Graduate Civil Engineer; Jun. Am. Soc. C.E.; 26; single; B.C.E., Brooklyn Polytechnic Institute, 1935; 10 months experience in large engineering office; made preliminary designs of reinforced concrete and steel structures; drafting for rigid-frame bridges, retaining walls, and building alterations. Desires steady employment in similar field. Available. D-4093.

Civil Engineer; Jun. Am. Soc. C.E.; single; 27; B.C.E., University of Minnesota, 1932; 6 months inspection of materials; 4 months concrete technician; 14 months transit and plane-table topographical surveys; 6 months soil analysis and studies; desires employment in soils studies or construction. Now employed. D-3879.

Engineer; Jun. Am. Soc. C.E.; 24; single; B.S. in C.E., Newark College of Engineering, 1934; also B.S. in E.E., 1936, same college; 6 years experience in electrical construction. Desires opportunity in either civil or electrical engineering or a combination of both; location anywhere in the United States; available immediately. D-5323.

Civil Engineer; Jun. Am. Soc. C.E.; 23; married; B.S.C.E., Lafayette College, 1935; Tau Beta Pi. Short time with U. S. Coast and Geodetic Survey; hydraulics, piping, testing in industrial engineering test department. Past 10 months in bridge office of large railroad, computing, estimating, detailing, drafting. Desires opportunity in any branch of civil engineering. Location immaterial for reasonable salary. D-4149.

Civil Engineer; Jun. Am. Soc. C.E.; 27; single; B.S., 1933; C.E., 1934; sanitary and structural option, Columbia University; 13 months computer; U. S. Coast and Geodetic Survey; 4 months topographic draftsman; 9 months draftsman, marine work. Employed now. Desires position in construction or design in sanitary or structural fields. Available in one week. D-3061.

Sanitary Engineer; Jun. Am. Soc. C.E.; 26; single; B.S.C.E. and M.S.S.E.; 2½ years experience in municipal survey work; 2 years sales experience; 1 year in sewage research. Desires employment in operation, design, or construction in water supply, sewage disposal, or public health work. D-5448.

Miscellaneous

Municipal Engineer; Assoc. M. Am. Soc. C.E.; licensed professional engineer, New Jersey; 35; married; graduate; 10 years varied experience in design, supervision of construction, and maintenance of public utilities as assistant city engineer; desires work with public works agency on utility installation and maintenance. Employed; available in two weeks. D-5254.

Structural Draftsman; Assoc. M. Am. Soc. C.E.; married; 34; 14 years practical experience; 4 years in bridge company; 10 years in leading consulting engineers' offices. Thoroughly familiar with shop practice, structural detailing, drafting, and checking. Desires position along similar lines with consulting engineers, structural companies, or contractors. Can furnish references. Eastern location preferred. D-5430.

Sales

Sales Engineer; M. Am. Soc. C.E.; registered engineer, Pennsylvania; thoroughly experienced in structural steel engineering and sales. Particularly well acquainted with Cleveland, Pittsburgh, and tri-state area. Available immediately. C-5095.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1936. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

Bewegliche Brücken, Berechnung und Konstruktion. By A. Hawranek. Berlin, Julius Springer, 1936. 298 pp., illus., diagrs., charts, tables, 11 × 8 in., cloth, 48 rm.

In this treatise on movable bridges, a discussion of the general problems connected with such bridges is followed by sections on their ordinary elements and on the basic elements of their machinery. Succeeding sections are devoted to swing, lift, bascule, draw, and roller bridges, car-ferry and landing bridges, pontoon bridges, and aerial ferries. Welding and bridge erection are also discussed. The work contains drawings and descriptions of many important bridges and has a useful bibliography. It is an important addition to the literature of the subject.

Bituminous Pavements. By A. R. Ebberts and H. Johnstone. Pittsburgh (6139 Jackson St.), A. R. Ebberts and H. Johnstone. 1936. 95 pp., illus., diagrs., charts, tables, 11 × 7 in., paper, $2.

This handbook is intended to provide a simple explanation of the technical terms used in the asphalt paving industry and of the general principles underlying the design and construction of bituminous pavements. The materials used, the various types of pavements, the design of mixtures and the control of their manufacture, and the construction of pavements and their maintenance and repair are discussed. Officials and others in search of a concise introduction to the subject will find the work helpful.

Elementary Treatise on Statically Indeterminate Stresses. By J. I. Parcel and G. A. Maney. 2 ed. New York, John Wiley & Sons, 1936. 432 pp., illus., diagrs., charts, tables, 9 × 6 in., leather, $5.

The principal changes in this edition are the expansion of the treatment of the rigid-joint structure to include an account of the Cross method of moment distribution; a generalization of the slope-deflection method; an analysis of the multi-storied building frame by the Maney-Goldberg and Cross methods; and the addition of an introductory treatment of the theory of suspension systems. In addition, errors have been corrected and the bibliography has been revised. The work aims to present the fundamental methods of attack on the problem of indeterminate stresses and to illustrate these methods by application to common types of structures.

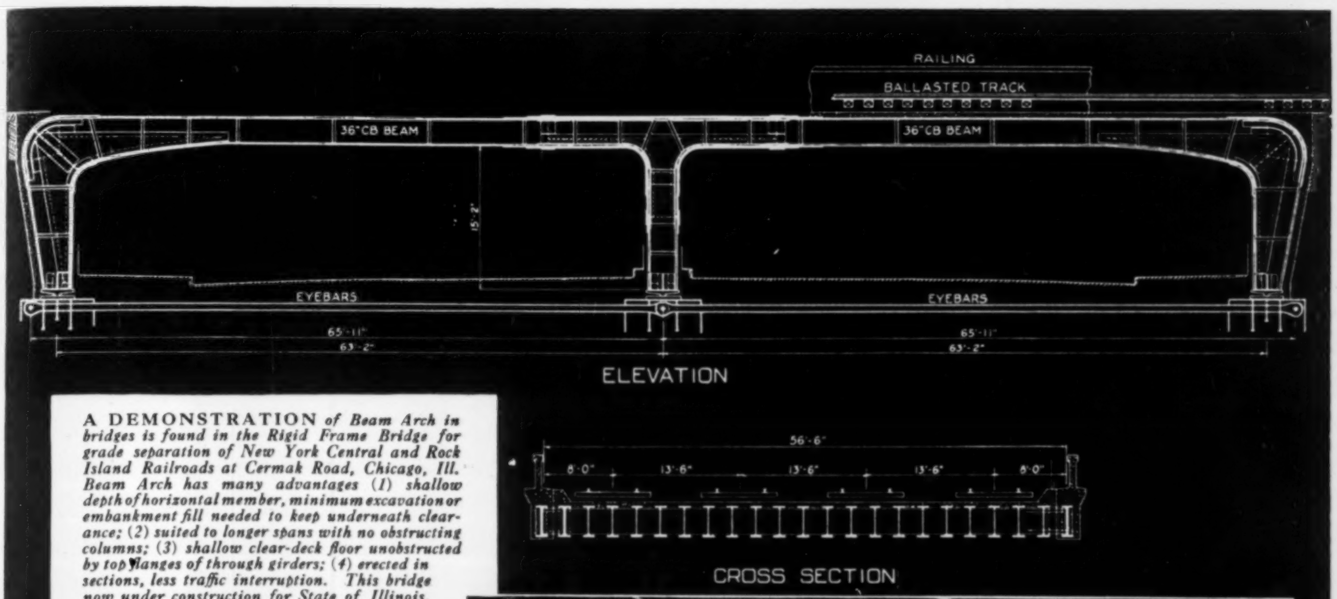
Public Utility Industries. By G. L. Wilson, J. M. Herring, and R. B. Eutsler. New York and London, McGraw-Hill Book Co., 1936. 412 pp., diagrs., charts, tables, 9 × 6 in., cloth, $3.50.

This work affords a survey of the economic, legal, and social characteristics of public utility enterprises, together with a critical study of their organization, management, services, and rate structures. The utilities discussed include the gas industry, the electric light and power industry; water-supply; utility, public automobile transportation; urban street-car, bus, and rapid-transit transportation; interurban electric railway transportation; pipeline transportation; and telephone, telegraph, cable, and radio communication. The book is intended as an introduction to the broader problems common to all utilities, which will serve as a background for the intelligent discussion of rates, regulation, and similar subjects.

Announcing . . .

BEAM ARCH CONSTRUCTION

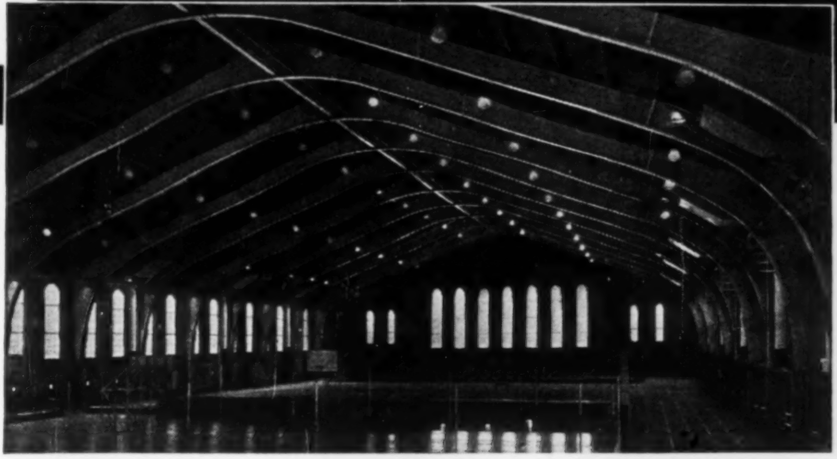
applied to Rigid Frame Bridge



A DEMONSTRATION *of Beam Arch in bridges is found in the Rigid Frame Bridge for grade separation of New York Central and Rock Island Railroads at Cermak Road, Chicago, Ill. Beam Arch has many advantages (1) shallow depth of horizontal member, minimum excavation or embankment fill needed to keep underneath clearance; (2) suited to longer spans with no obstructing columns; (3) shallow clear-deck floor unobstructed by top flanges of through girders; (4) erected in sections, less traffic interruption. This bridge now under construction for State of Illinois, Dept. of Public Works and Bldgs., Division of Highways, Ernest Lieberman, Chief Engineer.*

THE sweeping curve of roof construction and the vaulted profile of bridge spans can now use to advantage the Beam Arch as developed by American Bridge Company. In addition to its innate beauty it has many economies—it is fabricated from Carnegie-Illinois rolled CB beams; it is shipped in large sections to simplify and speed field erection; it has low maintenance costs for the large plain surfaces are easily inspected and painted, while offering no inaccessible surfaces or pockets to collect dirt.

Beam Arch construction is new and modern. It offers the ultimate in appearance, strength and economy. Call on us for additional information or suggestions.



THIS FIELD HOUSE *for University of Chicago built in 1931, the first major installation of American Bridge Company Beam Arch, demonstrated the advantages for buildings—(1) long span construction (spans up to 200 feet have been built); (2) no interior posts or deep trusses, unobstructed light, ventilation and vision; (3) balconies may be cantilevered from columns, no unsightly hangers above or posts below; (4) shallow depth of arch member, lower roof line reduces height of enclosing walls. Field House is 168'2" wide, 68' high at center. Architects, Holabird & Root; Associate Architect, Emery B. Jackson.*

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UNITED STATES STEEL

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BRIDGES

Concrete Arch, Spain. Le viaduc en béton armé de l'Esla (Espagne), M. Jacobson. *Génie Civil*, vol. 109, no. 2817, Aug. 8, 1936, pp. 126–127. Progress report on construction of concrete-arch railroad bridge of Esla, Spain, consisting of single arch 205 m in span, which is world's record, and having total length of 480 m; details of arch reinforcement; construction of abutments and piers.

Concrete Frame, Texas. Apply Rigid-Frame Design in Subway at Ringgold, Tex. *Ry. Age*, vol. 101, no. 8, Aug. 22, 1936, pp. 271–273. Example of rigid-frame type at grade separation of Chicago, Rock Island and Gulf Railroad at Ringgold, Tex., with clear width of 42 ft, clear height of 14 ft, and width of 33 ft.

Concrete Trestle. Build Low-Level Bridge to Solve High-Water Problem. *Ry. Age*, vol. 101, no. 5, Aug. 1, 1936, pp. 172–174. Reinforced concrete railroad trestle, 534 ft long, across Nueces River at Uvalde, Tex.; designed to resist effect of submergence in swift current at extreme flood stages, and consisting of 23 spans, each 23 ft 3 in. long supported on 22 piers and 2 abutments; slabs are 3 ft thick, 10 ft wide at bottom, and 12 ft wide at top.

Railroad, Rail Fastening. Fastening Rail to Bridge Floor, F. W. Capp. *Ry. Eng. & Maintenance*, vol. 32, no. 8, Aug. 1936, pp. 483 and 484. Advantages and disadvantages of ballast deck bridges and concrete bridge floors.

Railroad, Stresses. Impact on Bridges—Achievement in Research. *Ry. Age*, vol. 100, no. 23, June 6, 1936, pp. 906–909. Review of early investigations to determine impact of moving locomotives and cars on bridges; results of tests on 39 steel bridge spans involving taking data of 2,100 train movements by J. B. Hunley; work of Special Committee on Impact of Am. Ry. Eng. Assn.

Suspension, Cables. Spinning Cables in Saddles, J. H. Leon. *Eng. News-Rec.*, vol. 117, no. 9, Aug. 27, 1936, pp. 300–303. Method of spinning cables for suspension span of Triborough Bridge, New York City; advantages of spinning in saddle; clearance between strands; procedure at tower saddles; spinning details at tower saddles.

Suspension, Failure. Studies Mt. Hope Suspension Bridge Cable Wire Failure, W. H. Swanger and G. F. Wohlgemuth. *Steel*, vol. 99, no. 4, July 27, 1936, pp. 57–58. Results of investigation by U. S. National Bureau of Standards of failure of wire cables in bridge across Mt. Hope Bay between Bristol and Portsmouth, R.I., during construction.

Steel Arch, New York City. Designing Longest Fixed Steel Arch, D. B. Steinman and C. H. Gronquist. *Eng. News-Rec.*, vol. 117, no. 7, Aug. 13, 1936, pp. 232–236. Design and construction of Henry Hudson steel-arch bridge at northwest end of Manhattan Island (including main span 800 ft long, which is new record for hingeless steel arches), consisting of two box plate-girder ribs $12^1/_2$ ft deep and $3^1/_2$ ft wide, carrying 42-ft deck roadway; plated spandrel columns; live load assumptions; rib makeup; foundations; viaducts.

Suspension, Quebec. Island of Orleans Bridge, P. L. Pratley. *Eng. J.*, vol. 19, no. 7, July 1936, pp. 322–327. Construction of highway suspension bridge, across the channel of the St. Lawrence River from the Isle of Orleans to the mainland, having central span of 1,059 ft and total length, including approaches, of 6,000 ft. Before Eng. Inst. Can.

Suspension, San Francisco—Oakland Bay. Bay Bridge Suspended Structure, C. H. Purcell, C. E. Andrew, and G. B. Woodruff. *Eng. News-Rec.*, vol. 117, no. 8, Aug. 20, 1936, pp. 255–260. Analysis and details of design of San Francisco—Oakland Bay suspension bridges, totaling 8,300 ft in length; long side spans increase flexibility; trains make loading unsymmetrical; assembly line deck units lifted bodily to place.

Trestle. Power Tools Air Trestle Renewal, H. S. Loeffler. *Ry. Eng. & Maintenance*, vol. 32, no. 8, Aug. 1936, pp. 474–476, and 484. Renewal of 968-ft double-track frame trestle approach to Ore Dock No. 4 at Allouez, Wis., by Great Northern Railroad, using treated and untreated timber; elevation of typical bent; erection procedure during winter of 1935–1936.

Wrecking. Unusual Drilling Job, C. H. Vivian. *Compressed Air Mag.*, vol. 41, no. 7, July 1936, pp. 5066–5071. Dredging and drilling operations required for removal of piers of Bourne, Sagamore, and New York, New Haven and Hartford railroad bridges across Cape Cod Canal.

BUILDINGS

Concrete, Italy. La tour et le bâtiment de la colonie de vacances de la Société Fiat, à Marina di Mass, L. Faivre. *Génie Civil*, vol. 109, no. 2814, July 18, 1936, pp. 62–64. Description of newly erected concrete vacation building for children of workers of the Fiat Company of Turin, at Marina di Massa beach; 2-story structure, 85.4 m by 11.3 m by 9 m high, plus stairless circular 15-story tower, 24.2 m internal diameter, occupied by dormitories; details of double-sash windows.

Design. Site Planning and Sunlight as Developed by Henry Wright. *Am. Architect and Architecture*, vol. 149, no. 2648, Aug. 1936, pp. 19–22. Review of work at Town Planning Studio of Columbia University, N. Y., with use of Heliodon putting sunlight-control on scientific basis, affecting both site planning and architectural form.

Research. Building Research Station. *Roy. Inst. Brit. Architects—J.*, vol. 43, 3d series, no. 15, June 1936, pp. 789–802. Recent changes in building technique and how they were responsible for the creation of the Building Research Station at Garston; work of station at present and what it has so far accomplished; probable relations between building research and building technique in future.

CITY AND REGIONAL PLANNING

Resettlement. Greenbelt Towns, A. Mayer. *Am. City*, vol. 51, no. 5, May 1936, pp. 59–61. Planning of four towns in United States by Resettlement Administration near large industrial centers.

CONCRETE

Building Materials. Better Construction in Concrete, W. F. Lockhardt. *Am. Architect & Architecture*, vol. 149, no. 2648, Aug. 1936, pp. 56–64. Review of progress in manufacture and use of concrete wall block and concrete building tile; heat transmission of various types of concrete masonry residence walls; rating chart for relative cost and relative insulating efficiency; monolithic concrete; recommended minimum thicknesses and thermal insulation of reinforced concrete walls; thermal insulation of flat concrete residence roofs and floors.

DAMS

Construction, Accident Prevention. Plenty of Hazards, but Energetic Safety Program at Wheeler Dam, G. A. Schweppe. *Nat. Safety News.*, vol. 33, no. 2, Feb. 1936, pp. 11–14. How safety work is organized; fire prevention; public safety; illustrations given.

Construction, Welding. Grand Coulee Construction Work Speeded with Use of Welding and Cutting, H. W. Young. *Welding Engr.*, vol. 21, no. 6, June 1936, pp. 28–30. Mammoth steel cofferdam is welded completely tight; welding shop consumes 1,000 lb of welding rods per week; arc welder repairs worn bucket teeth, etc.

Earthquake, Resistance. Earthquake-Proof Earth Dams, F. H. Tibbetts. *Eng. News-Rec.*, vol. 117, no. 1, July 2, 1936, pp. 10–13. Anti-earthquake design of five roll-fill earth dams built for Santa Clara Water Conservation District, located on five principal streams flowing into valley over shattered and shaken bedrock, between San Andreas and Hayward faults in California.

Hydraulic Fill, Montana. Fort Peck Dam Today. I—Impressions of Year's Progress, H. W. Richardson. *Eng. News-Rec.*, vol. 117, no. 4, July 23, 1936, pp. 105–109. Review of one year's progress in construction of world's largest earth dam; hydraulic filling on main dam, driving of diversion tunnels, and construction of spillway; control shafts; channel lining.

Inspection. Nine Hundred Dams Inspected, G. W. Hawley. *Eng. News-Rec.*, vol. 117, no. 3, July 16, 1936, pp. 71–76. Six-year California investigation, showing one-third of all dams needing repair, major defects in foundations, inadequate spillways, or inadequate materials of construction; program of examination; safety conditions; features of major dams.

Reservoirs, Great Britain. Construction of Cheddar Reservoir, R. W. Hall. *Surveyor*, vol. 89, no. 2314, May 29, 1936, pp. 733–735; see also *Water & Water Eng.*, vol. 38, no. 465, midsummer 1936, pp. 367–376. Reservoir of Bristol water works, with capacity of 1,250,000,000 gal, is approximately circular in shape, and formed by earthen bank over two miles long which will enclose area of 230 acres; height of bank varies from 3 ft at northeast where ground is high to 44 ft in depression at west end.

FOUNDATIONS

Design. Étude des constructions reposant sur un sol élastique, F. Szeps. *Revue Universelle des Mines*, vol. 12, no. 3, Mar. 1936, pp. 94–104. Theoretical discussion of design of foundations on elastic ground for walls, locks, columns, etc.; design of foundation slabs, taking into account bending of slabs.

Ground Water. Tracing Loss of Ground Water, B. F. Snow. *Eng. News-Rec.*, vol. 117, no. 1, July 2, 1936; pp. 1–6. Original water table disturbed by underground services is being restored to save building foundations in Back Bay district of Boston; damage to pile foundations of Public Library; early water-level records; effect of subway construction; levels checked against rainfall; possible ground-water replenishment.

Soils, France. Etude systematique des fondations, Parmentier and Mayer. *Annales de l'Institut Technique*, vol. 1, no. 1, Jan.-Feb., 1936, pp. 64–75, (discussion) 75–77. Review of systematic study of foundation soils in France; physical and mechanical characteristics of typical soils tested at French Laboratory of Soils and Foundations during 1935; review of theory of earth pressure; description of testing apparatus for measuring internal friction and cohesion compressibility and permeability of soils; studies of dam foundations.

BETHLEHEM *Steel* H-PILING

for hard driving in long lengths

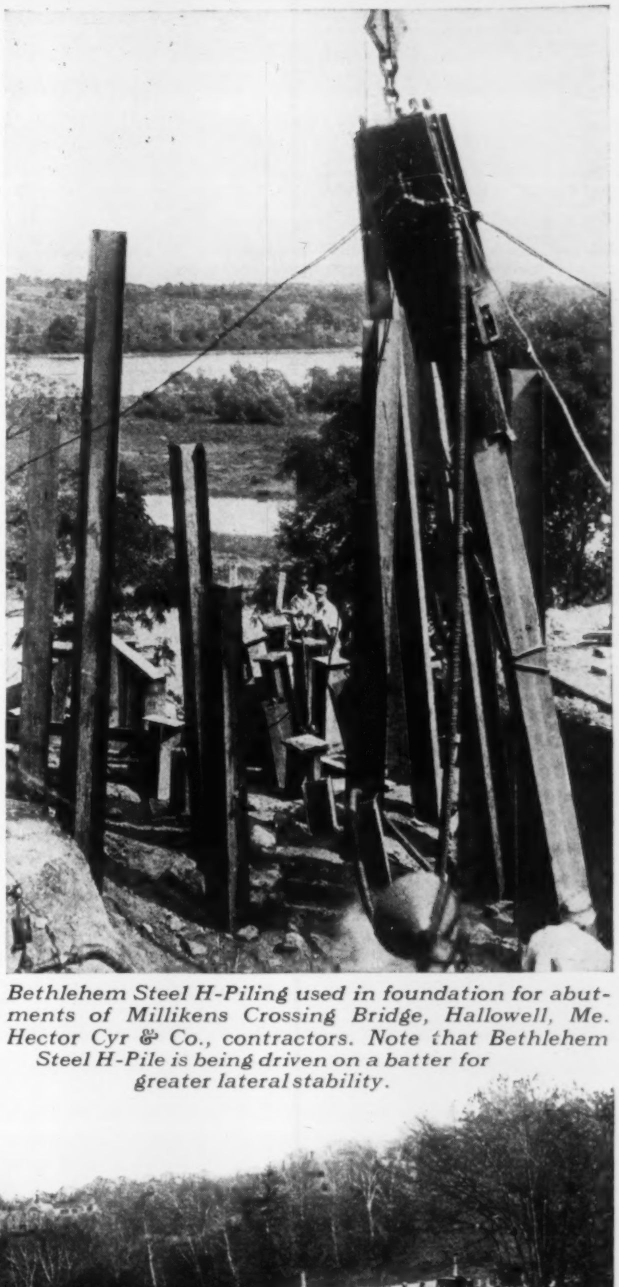
Unfavorable driving conditions encountered in any soil structure don't faze Bethlehem Steel H-Piles. Witness their successful application in the five piers and two abutments of this bridge at Hallowell, Me., built to eliminate a grade crossing.

In the natural ground on one side of the railroad tracks, strata of rocks and gravel overlie a stratum of soft clay several feet thick. On the other side the ground was filled earth and contained a large number of boulders, probably debris from an old stone masonry retaining wall.

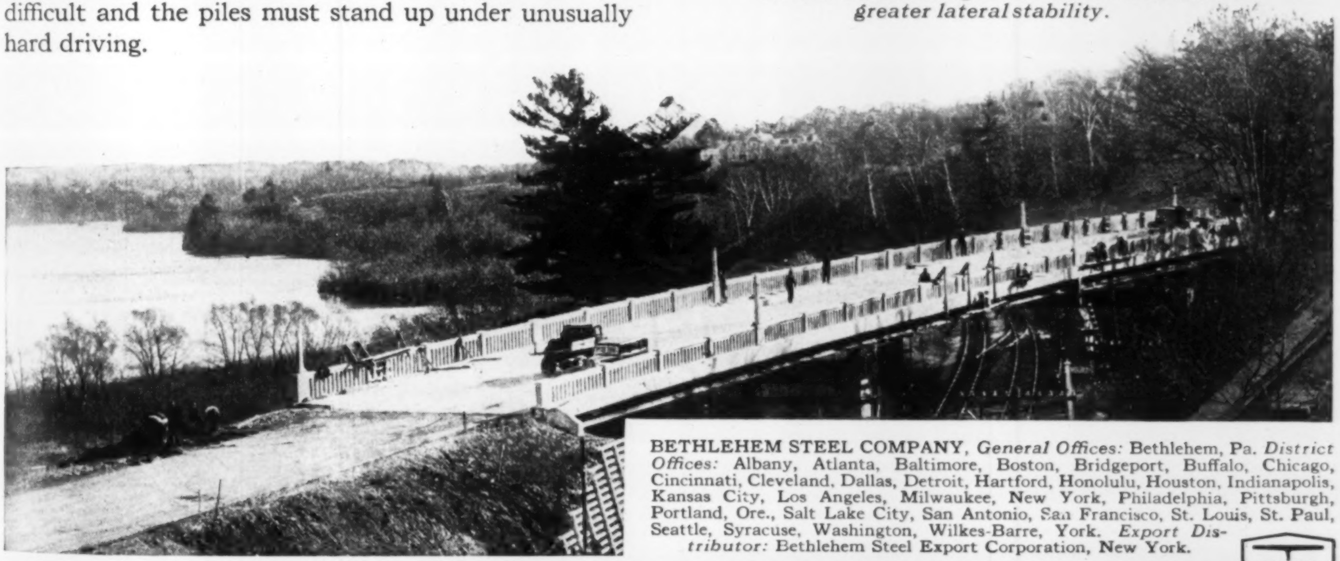
Despite these difficulties Bethlehem Steel H-Piling was quickly and easily driven to refusal. The penetration of the piling varied from 40 to 80 ft., with the longer lengths being spliced on the job. In addition to being driven in a plumb position, some of the piles were driven on a batter for greater lateral stability.

This ability to withstand hard driving and to penetrate to rock or practical refusal in all types of ground material is outstanding. But it's only one of the features that recommend Bethlehem Steel H-Piling to your consideration for many types of foundation work. H-piling has unusually high column strength and long life. Its strength is unaffected by splicing and it is both easy and economical to drive.

Throughout the country, engineers have found that Bethlehem Steel H-Piling is often the most logical and satisfactory bearing pile to use wherever penetration is difficult and the piles must stand up under unusually hard driving.



Bethlehem Steel H-Piling used in foundation for abutments of Millikens Crossing Bridge, Hallowell, Me. Hector Cyr & Co., contractors. Note that Bethlehem Steel H-Pile is being driven on a batter for greater lateral stability.



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SOILS, UNITED STATES. Soil Mechanics Notes—I. *Eng. News-Rec.*, vol. 117, no. 4, July 23, 1936, pp. 114–117. Abstracts of papers presented at International Conference on Soil Mechanics and Foundation Engineering held at Harvard University; asphalt stabilized samples; cone penetrometer surveys; foundation of Lottery Building in Mexico City; compacting new earth fills; tamping devices; vibration; jetting and rolling; fill settlement by vertical sand drains.

HYDROELECTRIC POWER PLANTS

FRANCE. Amenagement de la chute de la Roche-au-Moine, G. Laporte. *Travaux*, no. 35, Nov. 1935, pp. 403–415. Description of recently completed stand-by hydroelectric power plant near Eguzon, France, including equalizing storage reservoir, with capacity of 4,300,000 cu m, with automatic gate; gravity dam creating head of about 20 m; details of mechanical and electrical equipment.

HYDROLOGY AND METEOROLOGY

POWER PLANTS, EARTHQUAKE EFFECT. Power Plants and Earthquakes, P. E. Stevens. *Eng. News-Rec.*, vol. 117, no. 4, July 23, 1936, pp. 122–123. Recommendations for earthquake design; measures taken for increasing earthquake resistance of plant of San Diego Consolidated Gas and Electric Company. Abstract of paper before Midwest Power Conference in Chicago.

INLAND WATERWAYS

CANALS, LINING. Subgrader and Concrete Finisher Speed Construction of Large Canal. *Construction Methods*, vol. 18, no. 5, May 1936, pp. 30–33. Equipment and methods used for concrete lining of Colorado River aqueduct canal, 62 miles long, having water depth of 10.2 ft and top width of 57 ft; accurate trimming of bottom and sides of excavated canal section by mechanical subgrader; vibrating of concrete lining.

LAND RECLAMATION AND DRAINAGE

EROSION, CONTROL. Flusskorrektionen und Wildbachverbauungen im Kanton Glarus Blumer. *Wasser- u Energiewirtschaft*, vol. 27, nos. 7-8 and 9-10, July-Aug., 1935, pp. 92–97, and Sept.-Oct., 126–130. Review of silt and erosion control, also improvement of torrential mountain streams by check dams and other methods carried out in Canton of Glarus, Switzerland; lining of power canals; financing of works. (Brief French abstract, pp. 129 and 130.)

MOSQUITO CONTROL. Mosquito Control Engineering—I, II, and III. *Eng. News-Rec.*, vol. 117, nos. 4, 6, and 7, July 23, 1936, pp. 118–122; Aug. 6, pp. 199–201; and Aug. 13, pp. 225–228. Symposium consisting of the following papers: July 23: Growth and Importance of Anti-Mosquito Work, L. O. Howard; Aug. 6: Mosquitoes—Species and Habits, T. J. Headlee; Aug. 13: Control Technique and Organization, R. W. Gios.

RECLAMATION OF LAND. Case for Land Improvement and Reclamation, R. G. Stapledon. *Roy. Soc. Arts—J.*, vol. 84, no. 4367, July 31, 1936, pp. 972–985 (discussion), 985–994. Reasons prompting author's stand for land improvement are stated and discussed.

PORTS AND MARITIME STRUCTURES

COPENHAGEN. Port of Copenhagen, R. L. Simons. *Naut. Gaz.*, vol. 126, no. 13, June 20, 1936, pp. 6–7 and 30. Brief note on new Knippelsbro Bridge; port characteristics and features; statistical data.

DOCKS, NEW YORK CITY. Construction Features of Transatlantic Terminal. *Mar. News*, vol. 23, no. 3, Aug. 1936, pp. 22–24. Data on building of longest piers in Manhattan cofferdam construction; pile portion of piers; sheds; architectural features.

HAMPTON ROADS, VA. Port of Hampton Roads, Virginia, W. A. Cox. *Mar. News*, vol. 23, no. 1, June 1936, pp. 26–29. Port features, characteristics, and facilities.

JETTIES, MAINTENANCE AND REPAIR. Rubble Jetties Made Solid with Asphaltic Concrete, F. B. Wilby. *Eng. News-Rec.*, vol. 117, no. 8, Aug. 20, 1936, pp. 263–265. Method of repairing jetties at Galveston, Tex.; hot asphalt mix poured through water penetrates rubble fill and builds up smooth cap under action of vibrators; asphalt and cement compared; truck delivery of asphalt; experimenting on jetty repair.

NEW YORK CITY. Port of New York Authority. *Engineer*, vol. 162, no. 4199, July 3, 1936, pp. 2–4. Brief account of outstanding engineering constructions carried out by this organization, including the Holland Tunnel, the Arthur Kill bridges, the George Washington Bridge, the Bayonne Bridge, Inland Freight Terminal No. 1, and the Midtown Hudson Tunnel.

ROADS AND STREETS

BRICK. 35-Year-Old Brick Pavement Rejuvenation, Fort Scott, Kans., F. D. Martin. *Roads & Streets*, vol. 79, no. 8, Aug. 1936, pp. 25–28. Brief account of construction operations.

CONCRETE. Modern Concrete Pavement Construction Methods, D. O. Robinson. *Eng. J.*, vol. 19, no. 6, Aug. 1936, pp. 359–366. Rules affecting proper unit costs; important considerations in long-time planning of highway system; proper selection of materials and equipment; approved methods of construction. Before Eng. Inst. Canada.

CONSTRUCTION. Roads of Today, W. S. Powell. *Compressed Air Mag.*, vol. 41, no. 7, July 1936, pp. 5076–5081. Types of roads in England in eighteenth and nineteenth centuries; early roads in United States; organization of state highway departments; examples of modern types.

CURVES. Note sur les raccordements progressifs dans les tracés de routes, P. Cot. *Annales des Ponts et Chaussées*, vol. 106, no. 5, May 1936, pp. 546–553. Theory of design of progressive transition curves for modern highways.

HIGHWAY ACCIDENT PREVENTION. Highway Safety Closely Related to Diversion of Highway Funds, A. H. Hinkle. *Roads & Streets*, vol 79, no. 8, Aug. 1936, p. 44. Need for improvements in highway design, traffic signs, signals, and markings.

HIGHWAY SYSTEMS, EUROPE. La route internationale de Londres à Istanbul et les routes en Hongrie, E. Claeys. *Annales des Travaux Publics de Belgique*, vol. 37, no. 2, Apr. 1936, pp. 163–210, 5 supp. sheets. Present status of project for construction of modern highway from London to Istanbul, through Vienna, Belgrade, and Sofia; condition of highway systems in countries traversed.

MAINTENANCE AND REPAIR. New Surfaces on Old in Evanston, Ill., J. C. Black. *Roads & Streets*, vol. 79, no. 7, July 1936, pp. 21–25. Method of laying 2-in. asphaltic concrete surfaces on 35 miles of old macadam and brick pavements in Evanston, Ill.; mixing plant described; specifications of mix.

MAINTENANCE AND REPAIR, WINTER. Getting Roads Ready for Winter, G. E. Martin. *Pub. Works*, vol. 67, no. 8, Aug. 1936, pp. 9–10. Patching and drainage; preventing skidding; shoulder treatment; patching and sealing; crack and joint filling; re-tread treatment.

MATERIALS, BITUMINOUS. Tar as Road Material, W. J. Hadfield. *Quarry & Roadmaking*, vol. 41, no. 479, July 1936, pp. 188–191. Durability of tar; history of tarmacadam road; tar for surface dressing; progress in quality of tar; non-toxic tar; non-slippery surface; tarmacadam; tests of hot process tarmacadam; thin surfacing coats. Before Int. Road Tar Conference.

MOUNTAIN. Design and Construction Features of Blue Ridge Parkway, J. H. Spelman. *Roads & Streets*, vol. 79, no. 7, July 1936, pp. 27–30. Grading and surfacing operations on 119 miles of 500-mile parkway lying almost entirely above 2,500-ft elevation from Shenandoah National Park to Great Smoky Mountains National Park.

SALT STABILIZATION. Plant-Mixed Stabilized Construction in Illinois, J. C. Black. *Roads & Streets*, vol. 79, no. 8, Aug. 1936, pp. 21–24. Construction of 5.65 miles of salt-stabilized road in Henderson County, Illinois; operation of mixing plant; specifications of sand, gravel, and clay mix; equipment used.

TRAFFIC SURVEYS, ARKANSAS. Digest of Report on Arkansas Traffic Survey, L. E. Peabody. *Pub. Roads*, vol. 17, no. 6, Aug. 1936, pp. 113–127. Results of cooperative survey by Bureau of Public Roads and Arkansas State Highway Commission of amount, type, and distribution of traffic, to be used as basis for planning highway development; origin, destination, and movement of passenger cars and buses; analysis of truck and bus transportation at several locations; tourist traffic in Arkansas; axle loads and total gross loads of trucks and of trucks with trailers.

SEWERAGE AND SEWAGE DISPOSAL

ACTIVATED SLUDGE, OHIO. Oxidation of Sewage by Activated Sludge, P. D. McNamee. *Sewage Works J.*, vol 8, no. 4, July 1936, pp. 562–571. Results of experimental study made by U. S. Public Health Service, Cincinnati, Ohio; method for determination of oxygen demand of sewage in presence of activated sludge; biological oxygen demand of sewage and supernatant by dilution method; observed oxygen demands of sludge and sludge-sewage mixtures; rate of oxidation. Bibliography.

ACTIVATED SLUDGE, TESTS. Value of Laboratory Tests for Control of Activated Sludge Process, C. W. Klassen. *Sewage Works J.*, vol 8, no. 4, July 1936, pp. 673–676. Control tests and what they mean; activated sludge settleability; suspended solids; sludge index; dissolved oxygen; settleable solids (Imhoff cones); biochemical oxygen demand; nitrates; methylene blue stability; turbidity; dissolved oxygen in mixed liquor. From *Digester*, May 1936.

ACTIVATED SLUDGE, WISCONSIN. Tapered Aeration of Activated Sludges, L. H. Kessler, G. A. Rohlich, and J. Smart. *Mun. Sanitation*, vol. 7, no. 8, Aug. 1936, pp. 268–271. Redesign of plant at Monroe, Wis., to use tapered aeration, based upon experiments with oxygen utilization of sewage sludge mixture and oxygen demand tests.

BACTERIOLOGY. Isolating Typhoid Bacilli in Sewage, A. A. Hajna. *Mun. Sanitation*, vol. 6, no. 8, Aug. 1935, p. 234. Baltimore tests show feasibility of isolating these bacilli from mass of bacterial flora. Bibliography.

CHEMICAL PROCESS. Chemical-Mechanical Treatment of Sewage, S. I. Zack. *Mun. Sanitation*, vol. 6, no. 6, June 1935, pp. 172–176. Classification of impurities; action of chemicals and sewage; chemicals used in sewage treatment; degree of treatment and results accomplished; plants using chemical precipitation; Perth Amboy plant chemical-mechanical; application of chemical-mechanical methods at existing plants.

CHLORINATION. Discharge of Crude Sewage Into Tidal Waters, S. B. Thomas. *Surveyor*, vol. 89, no. 2316, June 12, 1936, pp. 797–798. Experiments in chlorination of crude sewage made with view to improving river conditions in Bristol. Before Instn. Mun. & County Engrs.

FUTURE TRENDS. Forecasting Trends in Sewage Disposal, W. Rudolfs. *Eng. News-Rec.*, vol. 117, no. 3, July 16, 1936, pp. 84–85. Physical treatment processes will next claim attention, and biological and chemical methods will be improved to give greater stabilization at less cost. Abstract of paper before Maryland-Delaware Water & Sewerage Assn.

PLANTS, BEAVER DAM, WIS. Gas Stored Under Pressure at Beaver Dam Sewage Plant, J. Donohue. *Mun. Sanitation*, vol. 6, no. 10, Oct. 1935, pp. 292–293, and 298. Plant completed in 1934 for population of 10,000 designed for dry weather flow of 2.2 mgd using separate sludge digestion type of treatment; spherical gas holder.

PLANTS, LOS ANGELES, CALIF. Underground Sewage Pumping Plant at Los Angeles. *Mun. Sanitation*, vol. 6, no. 10, Oct. 1935, pp. 294–295. Equipment of Los Angeles installation to handle 4,000 gal per min; only skylights and ventilators to appear above ground surface; area to be landscaped.

PLANTS, OPERATION. Reducing Cost of Sewage Treatment, W. B. Walraven. *Mun. Sanitation*, vol. 6, no. 7, July 1935, pp. 208–210 and 219. Contention that sewage disposal plant can be operated as modern business enterprise. Before Kansas Water & Sewage Assn.

RECENT PROGRESS. Recent Trends in Sewerage and Sewage Treatment, C. G. Hyde. *Mun. Sanitation*, vol. 7, no. 2, Feb. 1936, pp. 44–51 and 58. Review of progress in field during past year, with special emphasis on new developments.

SLUDGE. Centrifugal Dewatering of Sludges, P. B. Streander. *Water Works & Sewerage*, vol. 83, no. 6, June 1936, pp. 212–217. Design, construction, and operation of horizontal clarifier. (Concluded.)

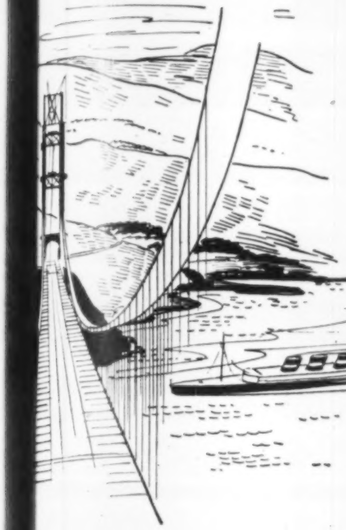
SEWERS, CLEANING. Operating Kinks in Sewerage Practice, A. M. Rawn. *Water Works & Sewerage*, vol. 83, no. 5, May 1936, pp. 173–175. Use of rubber beach balls, root cutters, air relief valve; grease collection and incineration.

STREAM POLLUTION. Sanitation in North Atlantic States, S. M. Ellsworth. *Mun. Sanitation*, vol. 7, no. 4, Apr. 1936, pp. 132–134 and 139. Tables showing methods of sewage disposal in major cities and districts and degree and extent of stream pollution. Before New England Sewage Works Assn.

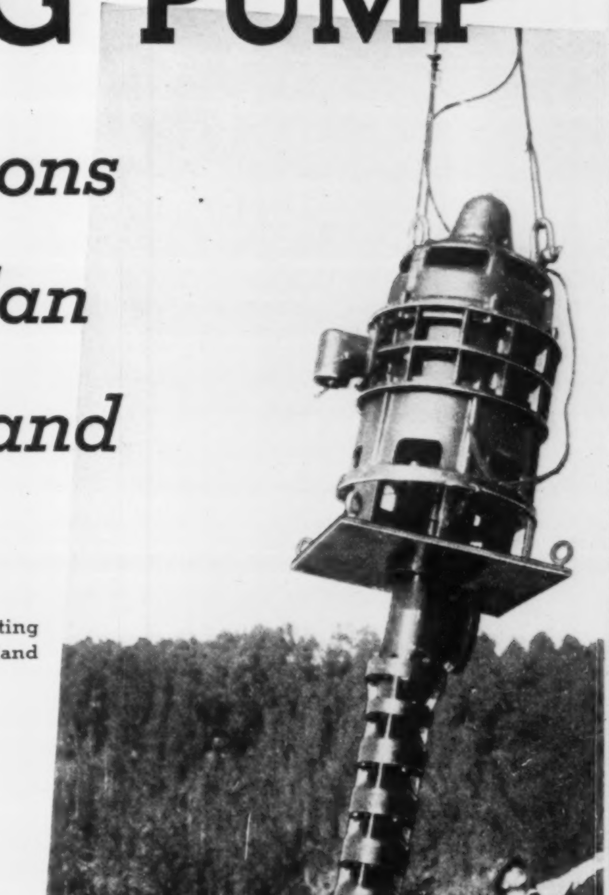
STRUCTURAL ENGINEERING

CONCRETE SLABS, STRESSES. Distribution of Shearing Stresses in Concrete Floor Slabs Under Concentrated Loads, M. G. Spangler. *Iowa State College of Agriculture & Mechanic Arts—Eng. Experiment Station—Bul.*, no. 126, vol. 34, no. 47, Apr. 22, 1936, 52 pp. Results of experimental study for determination of working values of effective width, by measuring distribution of shearing stresses induced by concentrated loads placed at various points on number of concrete floor slabs having various thicknesses, widths, and spans; laws governing this distribution.

NOVEL JETTING PUMP



helps sink caissons on great new San Francisco-Oakland Bay Bridge



The F-M Price Turbine Jetting Pump goes to work at Oakland

UNTIL the Transbay Construction Company started to work on the great bridge across the Golden Gate, jetting work for sinking caissons and piling was a job for a horizontal centrifugal pump.

Then they studied the characteristics of F-M Price Turbine pumps, and ordered a modified type for service in jetting away the sea bed for the bridge. With a few adaptations to fit it to handle sea water at terrific pressure, the pump was completed and delivered, its factory tests showing an overall pump efficiency of 82 per cent throughout a wide range of discharge pressures and efficiencies of 78 per cent or better through the entire expected working range of 225 to 325 pounds per square inch.

In regular service, it is working at 300 pounds pressure, but where formation resistance requires, pressure is increased to 400 pounds per square inch without difficulty.

Engineers and contractors requiring jetting equipment of unusually high efficiencies can obtain full information on this and other F-M pumps for engineering and hydraulic service from Department N-541, Fairbanks, Morse & Co., 900 S. Wabash Avenue, Chicago, Ill. 34 branches at your service throughout the United States.

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RAIL STEEL
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Stadiums, Steel. La tribune provisoire en tubes d'acier pour les représentations sur le Parvis Notre-Dame, à Paris, T. Moreau. *Génie Civil*, vol. 109, no. 2813, July 11, 1936, pp. 39–41. Design and construction of temporary grandstand at Notre Dame Plaza, in Paris, seating 10,000 spectators; supporting framework, 12.3 m maximum height, is constructed of steel pipes.

Welded Steel Structures, Stresses. Eigenspannungen in geschweissten I-Traegern, E. Gerold and H. Mueller-Stock. *Archiv fuer das Eisenhuettenwesen*, vol. 10, no. 1, July 1936, pp. 33–38. Internal stresses in welded I-beams; results of tests made by method of Siebel and Pfender, to determine stresses occurring in beams welded according to different processes.

TUNNELS

Construction, Groutings. Fort Peck Dam Today—IV. Grouting Tunnels, J. D. Jacobs. *Eng. News-Rec.*, vol. 117, no. 8, Aug. 20, 1936, pp. 274–277. Preparation for grouting; low-pressure operation; high-pressure grouting; organization.

Railroad, Old. Reinforced Concrete Lining Used to Advantage in Old Tunnel. *Ry. Age*, vol. 101, no. 7, Aug. 15, 1936, pp. 243–245. Method used by Pennsylvania Railroad in replacing old timber in 753-ft stone creek tunnel, on Marietta branch of Cleveland division, with 12-in. section reinforced by rods and 6-in. H-beam sets without encroaching on clearances.

Railroad, Surveying. Application of Precise Surveying to Tunnel Construction, F. S. Hutton. *Can. Engr.*, vol. 70, no. 26, June 30, 1936, pp. 5–10. Outline of procedure and need for accuracy stressed in prize thesis of University of Toronto.

Vehicular, Switzerland. Projet de tunnel routier traversant le massif du Saint-Gothard (Suisse), Edouard and G. Gruner. *Génie Civil*, vol. 109, no. 2815, July 25, 1936, pp. 82–86. Outline of project for construction of vehicular tunnel, 15 km long, under Mt. St. Gothard in Swiss Alps; review of experience, principally American and British, with ventilation of long tunnels; proposed structures and methods for ventilation of projected St. Gothard tunnel; estimate of costs; legal aspects of project; highway system of Switzerland.

Water Supply, Construction. Progress in San Jacinto Tunnel Speeded by Inclined Adit. *Eng. News-Rec.*, vol. 117, no. 4, July 23, 1936, pp. 110–111. Review of progress in construction of one of water supply tunnels of Colorado River aqueduct; line change, adding slightly to total length of 13-mile tunnel, gives access near midpoint; two pioneer bores started; time saving of many months will offset delays due to water inflow; mucking machines.

WATER PIPE LINES

Cross-Connections. Cross-Connection Hazards at Sewage Disposal Plants, C. E. Keefer. *Eng. News-Rec.*, vol. 117, no. 7, Aug. 13, 1936, p. 237. Chances of contamination of water supply; solution of problem.

Drinking Water, Lead Content. Lead Pipes as Source of Lead in Drinking Water, G. N. Quam and A. Klein. *Am. J. Pub. Health*, vol. 26, no. 8, Aug. 1936, pp. 778–780. Attempt was made to simulate actual conditions extant in water supply systems; methods of analysis were titrimetric extraction with diphenylthiocarbazone and colorimetric method based on use of diphenylthiocarbazone; observations reported make it appear obvious that domestic service pipe lines made entirely or even in part of lead should be flushed after period of rest before water is used. Bibliography.

WATER RESOURCES

Underground, Montana. Geology and Ground-Water Resources of Southeastern Montana, E. S. Perry. *Montana Bur. Mines & Geology—Memoir*, no. 14, Dec. 1935, 67 pp., 2 supp. sheets. Geology and hydrology of artesian basin along Powder, Tongue, and Yellowstone rivers, southeastern Montana; character of land surface; stratigraphy of southeastern Montana; shallow ground water; artesian water; chemical composition of ground water; drilling operations; description of districts. Bibliography.

Underground, Switzerland. Ueber Erscheinungen und Veraenderungen des Grundwassers in der Zone Wettingen-Baden nach dem Aufstau der Limmat, W. Harder. *Wasser- u Energiewirtschaft*, vol. 27, no. 11, Nov. 1935, pp. 135–142. Effect on ground-water level of surrounding territory of raising water level of Limmat Lake, in Switzerland; theoretical considerations and results of field observations showing rise of ground-water level amounting to about 20 m (brief French abstract, p. 142).

WATER TREATMENT

Coagulation, Virginia. Raw Water Preparation and Use of Chlorinated Copperas at Richmond, Va., M. C. Smith. *Water Works & Sewerage*, vol. 83, no. 7, July 1936, pp. 229–232. Coagulated water compared with filtered water; comparison of costs of four coagulants; experiences in efforts to improve coagulation; benefits of results obtained. Before Am. Water Works Assn.

Filtration Plants, Operation. Mud Ball Troubles. *Water Works Eng.*, vol. 89, no. 17, Aug. 19, 1936, pp. 1100 and 1103–1104. Practical discussion by water works superintendents of trouble experienced with mud balls in filter plants; effectiveness of treatment applied to correct trouble.

Iron Removal. Iron Removal Without Aeration, F. E. Hale. *Water Works Eng.*, vol. 89, no. 15, July 22, 1936, pp. 948–953. Removal of iron from oxygen-free well water at Flushing Pumping Station, Borough of Queens, New York City, without addition of air after extensive experimentation and by full-scale operation over 2-year period. Before Am. Water Works Assn.

Plants, St. Paul, Minn. Effects of Passing River Water Through Chain of Lakes, R. A. Thuma. *Water Works Eng.*, vol. 88, nos. 16, 17, and 18, Aug. 7, 1935, pp. 879–882; Aug. 21, pp. 934–936; and Sept. 4, pp. 987–989. Data gathered by Water Dept. of St. Paul, Minn., on temperature, color, odor, taste, and chemical qualities of St. Paul supply.

Plants, Wellington, Kans. Surface Supply to Replace Scant Ground-Water Resource, F. M. Veatch. *Water Works Eng.*, vol. 89, no. 12, June 10, 1936, pp. 758–760. Layout of plant for city with population of 7,500.

United States. Water Supply Filtration and Sewage Treatment in Cities Bordering Lake Michigan, R. T. Reilly. *Am. Water Works Assn.—J.*, vol. 28, no. 7, July 1936, pp. 896–907. Review of special water purification problems of Lake Michigan cities; relationship between water supply and sewage treatment; travel of pollution; turbidity; tributary population and pollution; corrective measures.

WATER WORKS ENGINEERING

Earthquake Effect. Earthquakes of 1935 and Helena, Montana, Water System, J. E. Lupien. *Am. Water Works Assn.—J.* vol. 28, no. 7, July 1936, pp. 908–911. Description of damage to water works system of Helena, Mont., caused by earthquake shocks of Oct. 1935.

Fort Smith, Ark. Water Works of Fort Smith, Ark., C. F. Byrns. *Water Works Eng.*, vol. 89, no. 17, Aug. 19, 1936, pp. 1068–1073. Design features of $1,650,000 plant for industrial city with population of 35,000; features include 80-ft earth dam, filtration plant with capacity of 8 mgd, 27-in. gravity steel pipe line 22.4 miles long, and cast-iron distributing mains.

Hygiene. Water Works Experiences from Health Official's Viewpoint, H. E. Moses. *Am. Water Works Assn.—J.*, vol. 28, no. 6, June 1936, pp. 681–689. Experience with some 700 water works for period of 25 years; reduction in typhoid fever; rising standards; chlorine; filtration; standards of quality; plant beautification; taste and odor; unsolved problems.

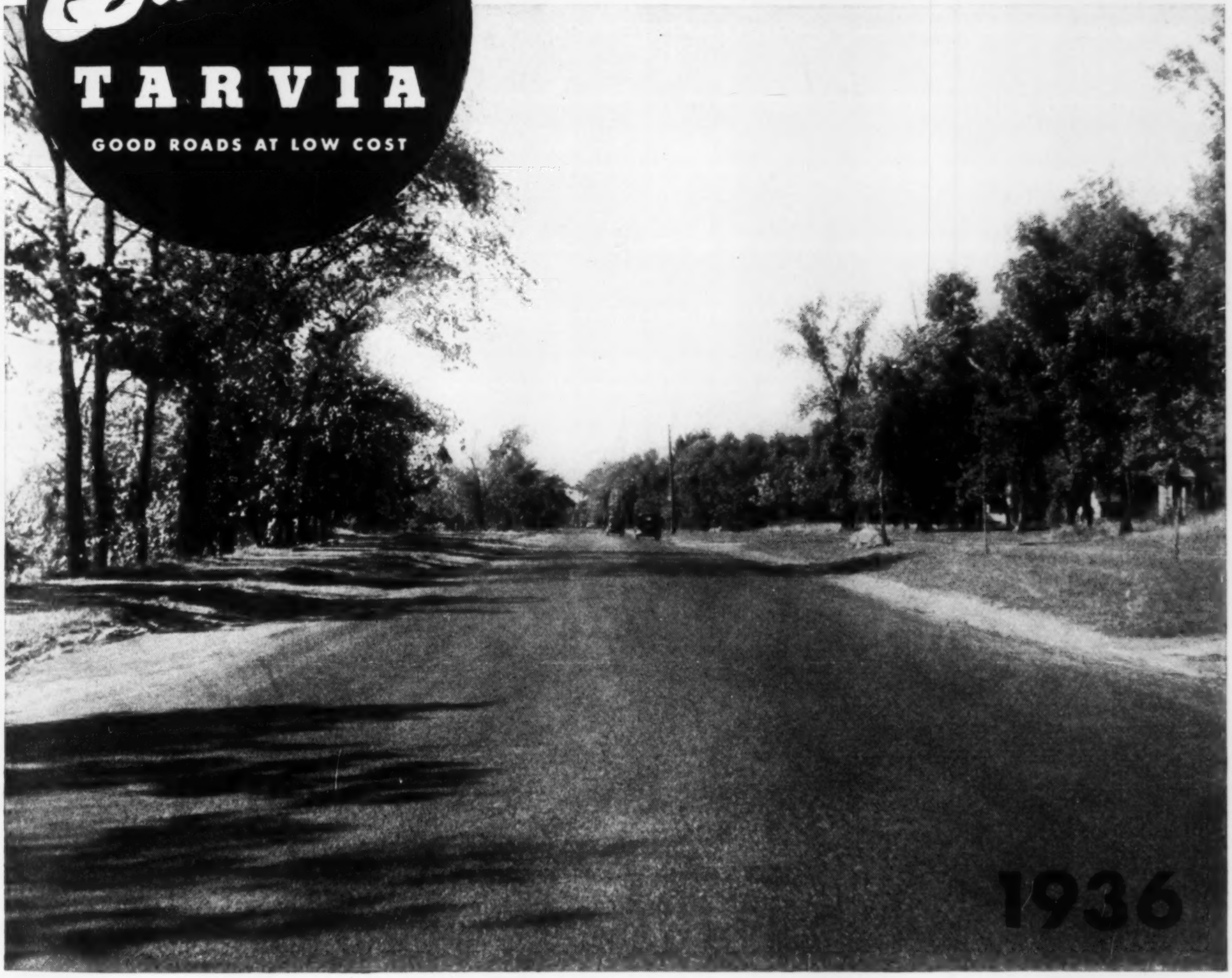
Uniontown, Ky. Flood-proof Plant Has Many Novel Features, E. C. Handorf. *Water Works Eng.*, vol. 89, no. 9, Apr. 29, 1936, pp. 482–485. Design of movable intake on trailer carriage due to shifting channel of Ohio River; pumping and filtration plant with capacity of 250 gal per min; distribution system; service meter boxes and meters; and elevated storage tank with capacity of 100,000 gal.

United States. Water Supply Operation Discussions—A.W.W.A.'s Los Angeles Convention. *Eng. News Rec.*, vol. 116, no. 25, June 18, 1936, pp. 887–891. Proceedings of 1935 annual meeting of American Water Works Assn., including abstracts of papers and discussions on water supply in California, air conditioning, better water quality, tuberculation, residual chlorination control, plant management and operation, electrolysis in water pipes, and finance and management.

United States, Projects. How 2,000 Water Projects Were Made Possible, H. L. Ickes. *Water Works Eng.*, vol. 89, no. 11, May 27, 1936, pp. 643–644, 647–648, and 704. Program of U. S. Public Works Administration.

Wells, France. Century-Long Struggle for Deep Wells at Paris, France, J. R. Charles. *Water Works Eng.*, vol. 89, no. 7, Apr. 1, 1936, pp. 358–363. History of deep well drilling at Paris since 1830 when first artesian well was sunk to depth of 460 ft.

East River Boulevard, Minneapolis, Minnesota. Tarvia since 1910. One of the scores of Tarvia roads that have served Minneapolis continuously for twenty years or more.



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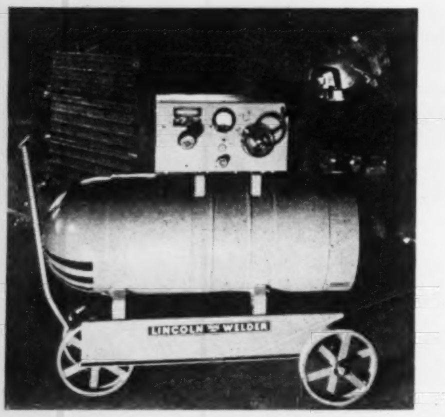
Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

New Continuous Dual Arc Control Welder

NEW SINGLE operator arc welders are announced by The Lincoln Electric Company, Cleveland, Ohio. These new welders will be known as the "Shield Arc SAE" and will supersede the present type of "Shield Arc" which have been on the market for the last six years. The predominating feature of this new arc welder is a new method of arc control which makes possible the adjustment of both arc heat and arc penetration in a continuous sequence of fine increments. It is claimed this continuous dual control assures absolute uniformity of performance at every control setting and adds greatly to the successful operation of arc welding. For certain types of arc welding a low voltage with wide range of current control is desired; for other types of work a higher voltage with the same wide range of current is desired. The new welder permits the use of the correct voltage and current for all classes of work in the range of each size of machine.



The new "Shield Arc SAE" welders are available in the following types and ratings: A.C. motor driven—200, 300, 400, and 600 amperes; D.C. motor driven—300, 400, and 600 amperes; generator for belt or couple service—200, 300, 400, and 600 amperes; and engine driven—200, 300, and 400 amperes.

Tractor Truck for High Speed Hauling

A NEW 40,000 lb gross capacity tractor truck, designed to meet the requirements for a compact high speed unit for heavy duty hauling is announced by the Four Wheel Drive Auto Company of Clintonville, Wisconsin, and Kitchener, Ontario, Canada.

The weight distribution of the tractor is 40% on front axle and 60% rear. The manufacturer states that the new tractor truck with semi-trailer is designed to carry a gross of 40,000 lbs distributed 10,000 lbs on the front axle of the tractor, 15,000 lbs on the rear axle of the tractor and 15,000 lbs on the axle of the semi.

According to the manufacturer, controlled power is the key to the truck's capacity for high speed hauling. Tires are 9.75–20, single front, duals rear. Frame height is 36 in. The springs of the truck are especially long, and shock absorbers are carried on the front axle to improve the riding qualities.

New Enamels Protect Metal from Corrosion

A NEW line of air-drying enamels, especially designed to prevent the corrosion of iron and steel in railroad, marine, mining, oil, and general industrial service, has been developed by Maas & Waldstein Company, Newark, N.J.

It is reported that these new anti-corrosive enamels are made of rust inhibiting pigments and a synthetic resin vehicle, and form a hard, tough coating that is resistant to wear and of pleasing appearance. According to the manufacturer, exposure tests, conducted for a long period of time, show that the enamels are particularly effective in providing protection from the corrosive action of humidity, salt water, and alkali, and in preventing electrolytic action.

Two New "Jackhamers"

Ingersoll-Rand has recently announced a new "Jackhamer" with which, it is claimed, users can get up to a third more drilling from their present compressor equipment. For example, if a portable compressor is now operating two 55-lb drills, three of the new JA-45 "Jackhamers" can be substituted, resulting in a one-third increase in drilling.

The JA-45 weighs about 45 lb and is about 21 in. in length. It is available in dry, wet, and blower styles. Bulletin No. 2266 describes this new "Jackhamer."

The "JA-30 Jackhamer," also introduced by Ingersoll-Rand, is a new drill for a multitude of jobs. It is already in wide use in place of heavier drills for light rock drilling, such as blockholing, trimming, scaling, holes for conduits, pipes, railings, foundation bolts, maintenance, and demolition work. Bulletin No. 2254 shows the JA-30 "Jackhammer."

Copies of bulletins on both drills may be had from the Ingersoll-Rand Company, 11 Broadway, New York, N.Y.

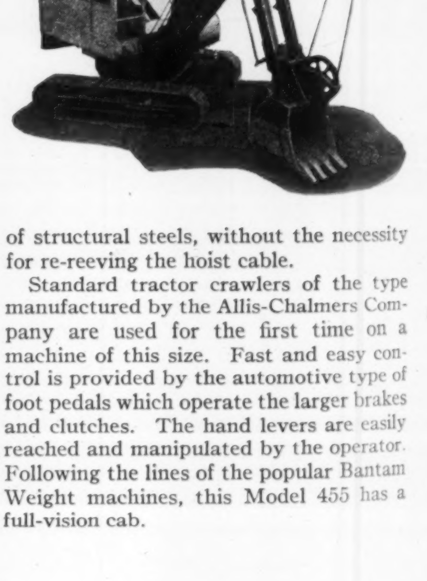
Atlas Explosives Catalog

The many different kinds of Atlas Explosives available to users are described in their new catalog. Several products exclusive with Atlas which have been widely accepted by industry are included—the Accordion Fold Electric Detonator package, Apex, the Twin-Fifty Blasting Machine, Blakstix, and others.

While this catalog is not intended as a handbook on the use of explosives, over 100 different grades of dynamite and a wide variety of accessories are listed, which will aid the user in choosing the supplies and explosives best suited to his job.

New 1-Yd Excavator

A high-speed excavator, Diesel or gasoline powered, known as the Model 455 with 1-yd. capacity and equipped with tractor-type crawlers, is announced by the Harnischfeger Corporation of Milwaukee. Specifically designed as an all-purpose machine, the weight of the Model 455 is radically reduced by the use of new high-tensile steels and electric welding. This new model is provided with 2-speed transmission for every movement in travel and digging, reported to assure accurate inch-spotting in such crane work as the placing of structural steels, without the necessity for re-reeving the hoist cable.

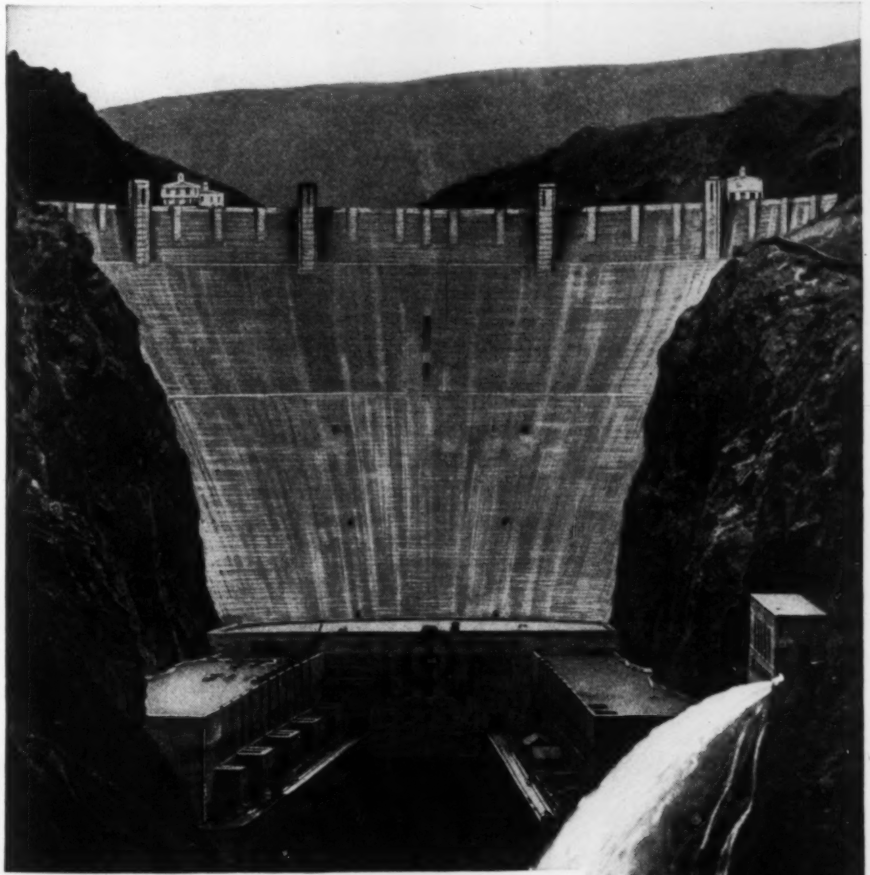


Standard tractor crawlers of the type manufactured by the Allis-Chalmers Company are used for the first time on a machine of this size. Fast and easy control is provided by the automotive type of foot pedals which operate the larger brakes and clutches. The hand levers are easily reached and manipulated by the operator. Following the lines of the popular Bantam Weight machines, this Model 455 has a full-vision cab.

400,000 POUNDS

—AND THEY CALL IT A "Butterfly"

That's the scale they do things on at Boulder Dam



Of course, it's not just *size* that counts, when you're deciding what metal to use to carry out the design for a job like the butterfly valves at Boulder Dam. Every ounce of metal used had to have the stamina to withstand the onset of tons of water for a generation or longer.

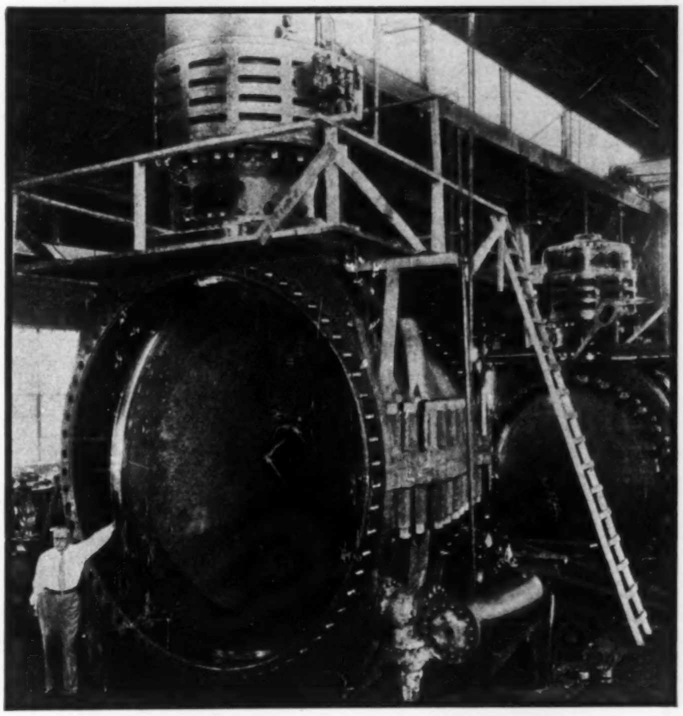
But size does matter—in more ways than one. It's more difficult to keep uniformity of grain texture, to hold the vital toughness, when your castings are 168 inches diameter, like this one. And think of the enormous cost of repairs and replacements . . . the engineers had to choose metals that would need none for years.

To assure these results, six 168-inch valves like this one were specified of a Nickel Alloy Steel, cast to this composition:

Carbon . . . . . 0.25—0.35%
Manganese . . 1.00% max.
Silicon 0.40%
Nickel . . . . . . 1.00—1.50%

With this analysis, the valves show a minimum tensile strength of 75,000 p.s.i., and a yield point of 50,000 p.s.i.

Main holding bolts require somewhat different properties, which Boulder Dam's engineers supplied with S.A.E. 2340, a 3½% Nickel Steel. Let the Inco engineers apply their wide experience to help you find the best type of Nickel Alloy Steel to fit your particular needs.



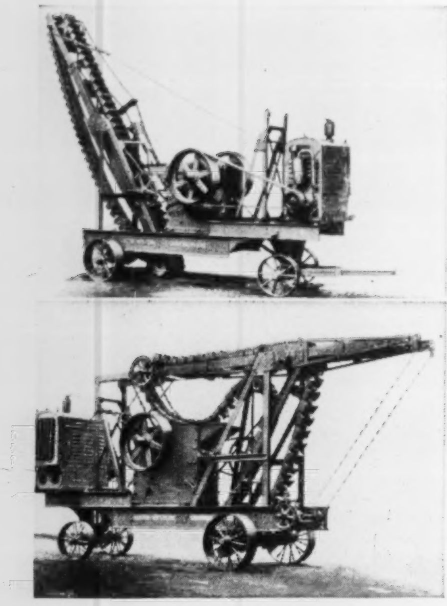
• One of six 168-inch butterfly valves for Boulder Dam, weight 400,000 pounds. These were made by Hardie-Tynes Mfg. Co., with Nickel Steel Castings containing 1 to 1.50% Nickel supplied by the Erie Forge Co.

NICKEL ALLOY STEEL

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

Portable Crushing Plants

A new line of small portable crushing plants for contractors and public officials has just been announced by The Austin-Western Road Machinery Company of Aurora, Ill.



Each unit of this line, known as the C.E.P. consists of a crusher, a folding elevator, and a motor, all mounted on a steel tired truck for easy transportation. The C.E.P. crushers in this line consist of eight sizes, with jaw openings of 9 by 16, 9 by 20, 12 by 20, 15 by 20, 4 by 40, 9 by 40, 18 by 38, and a roll crusher for crushing accurately sized stone with 30 in. rolls having a diameter of 18 in. Waukesha motors of suitable horsepower are used to power the new line and the power take-off is by a V-belt drive.

New Wagon-Scraper

The Tractor Equipment Division of the Continental Roll & Steel Foundry Company announces the addition of a new 10-yd Wagon-Scraper to their line of tractor and road building equipment.

This 10-yd, Wagon-Scraper, known as Model CS10A, is the full carrying type tractor scraper, identical in design and appearance to the Continental 5 and 7 yd Wagon-Scrapers, and embodying the same general operating features. It is ruggedly constructed throughout; overall length is 16 ft 9 in., width 11 ft 9$^{1}/_{2}$ in., height 6 ft 9 in.; and is built for use with 75 hp and larger tractors.

Improved Expansion Bolt

A new expansion bolt which is reported to assure holding power up to the breaking point of the bolt has been developed by the Chicago Expansion Bolt Company, 126 South Clinton Street, Chicago, Ill.

The bolt itself is steel and has a thin, steel-cone jacket under the bolt head, with a lead jacket on the outside. When placed in a hole and driven down with the application tool, the steel cone expands over the head of the bolt, the lead jacket expands over the steel cone and completely fills the hole around the shank of the bolt.

This bolt, called the Life-Time Expansion Bolt, is stocked in sizes of $^{1}/_{4}$ in. to $^{1}/_{2}$ in. diameter and 1$^{1}/_{2}$ in. to 8 in. long.

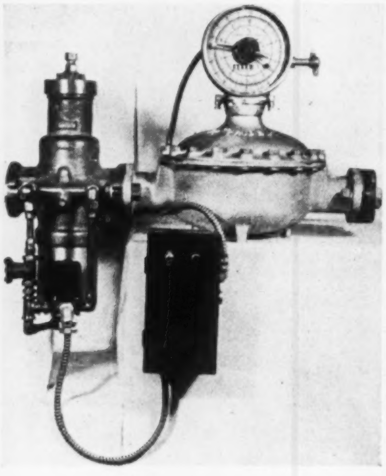
New Lamp Increases Light Shed on Streets

A new street lamp with a specially designed refractor, according to the announcement of General Electric Company, sheds 90 per cent more light on the street than comparable luminaires of older design.

The unit, known as Form-79R, is an addition to the company's new line of concealed-light-source luminaires, which direct a maximum of light to the street and thus suppress objectionable glare in upstairs windows and in the eyes of approaching motorists.

New Metering Valve

In line with the present trend toward accurate mixing water measurement for water-cement ratio control, the Spangler Manufacturing Company, 623 East Third St., Los Angeles, Calif., announces the Spangler Metering Valve. This valve which is reported to automatically measure water to a guaranteed accuracy of 1 per cent, is a compact, self-contained unit, and can be quickly and easily installed on any concrete mixer. It is completely automatic in operation and permits positive and convenient changing of the delivery volume by simply setting the dial to the desired amount. The operation is started by throwing the operator's lever, or in electrically operated batching plants, by simply pressing a button.



The meter is manufactured in several sizes, permitting the delivery of water in any desired quantities, from the smallest to the largest jobs.

Folders Announced

Ammeters and Voltmeters—Bulletin No. 436 covers a new line of round chart recording voltmeters and ammeters for electric utilities and industrial plants, illustrated. Bristol Co., Waterbury, Conn.

Barrett Products—Boulder Dam. In an attractive booklet of 16 pages, 8$^{1}/_{2}$ by 11 in., Barrett Company presents a brief picture-story of the building of Boulder Dam. The last few pages illustrate the uses of Barrett Products on the dam. Barrett Company, 40 Rector Street, New York, N.Y.

Belting—New Economics in Power Transmission, 8$^{1}/_{2}$ by 11 in., 6 pages, illustrated. Charles A. Schieren Company, 30 Ferry Street, New York, N.Y.

Blasting—"Gasoline Flows Under a River." An article in the DuPont Magazine for September discusses under water blasting operations in the laying of a gasoline line under the Susquehanna River, near Harrisburg, Pa. E. I. du Pont de Nemours & Company, Wilmington, Del.

Earth Moving—A LeTourneau Slide Rule for the computation of time cycles; maximum grades over which twelve combinations of tractors and hauling units will travel; trips per hr; yds per hr, etc. in moving earth. Pocket size. R. G. LeTourneau, Inc., Peoria, Ill.

Insulations—The 1936 edition of the Johns-Manville Industrial Products Catalog covers high and low temperature insulations; bonded asbestos built-up roofs; insulated roofs; corrugated Transite; Transite Conduit and Korduct; Asbestos Ebony and other J-M electrical materials; rock cork pipe covering; Steeltex Floor Lath and welded wire reinforcement. 8$^{1}/_{2}$ by 11 in., 60 pages, illustrated. Johns-Manville Corporation, 22 East 40th Street, New York, N.Y.

Meteorological Equipment—An abridged catalog of Friez standard instruments for the measurement of weather; water resources; upper air explorations; air conditioning and soil conservation. 8$^{1}/_{2}$ by 11 in., 16 pages, illustrated, Julien P. Friez & Sons, Inc., Baltimore, Md.

Sedimentation Basins—Steel Sedimentation Basin with an Internal Spiral Baffle, 8$^{1}/_{2}$ by 11 in., 12 pages, including descriptions of the basins, their parts and construction, a table of capacity of cylinders, and blue prints of the baffles, mixing chambers, connections, etc. Pittsburgh-Des Moines Steel Company, Neville Island, Pittsburgh, Pa.

Sewage Gas Engines—Blue Streak Sewage Gas Engines, 8$^{1}/_{2}$ by 11 in., illustrated. Climax Engineering Company, 111 W. Monroe Street, Chicago, Ill.

Tractors—Cletrac Facts, 10 by 14 in., 8 pages, illustrated. Features Cletrac Off-Track equipment for railroad construction and maintenance; and Cletrac in dirt moving, in moving industrial materials and in moving machinery. Cleveland Tractor Company, Cleveland, Ohio.

'Incor' Saves $734 on Forms, plus $802 Heating Expense

WINTER-BUILT HEATING TUNNEL ILLUSTRATES TWO-WAY SAVING WITH 'INCOR'

NINE hundred foot heating tunnel (shown above), at Kansas City, Mo., General Hospital, was constructed in mid-winter. Department of Public Works Engineers specified 'Incor', to insure watertightness, reduce form costs, and cut heat-curing time.

Construction proceeded without interruption, in spite of below-freezing temperatures. Form cost was $416, compared to an estimated $1,150 with ordinary Portland cement. Heat savings, including labor and fuel, amounted to $802—total saving, $1,536. Inspection shows tunnel to be watertight—100%.

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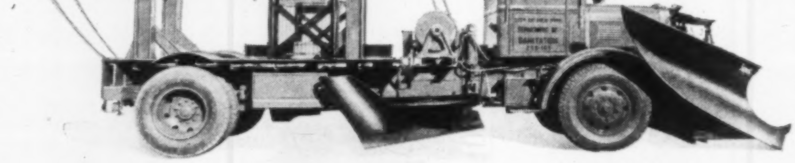

● The wrecker truck, like this one of twenty on a regular beat in New York City, does a giant's job every day. Its makers, Four Wheel Drive Auto Co., Clintonville, Wis., built it to stand overloading as regular routine. Wherever shock and fatigue strike hardest, this firm uses Nickel Steels: In axle differential gears and drive shafts, Nickel-molybdenum steels corresponding to SAE 4615 and 4340. In other highly stressed parts, other Nickel and Nickel-chromium steels assure the needed reserve of strength.

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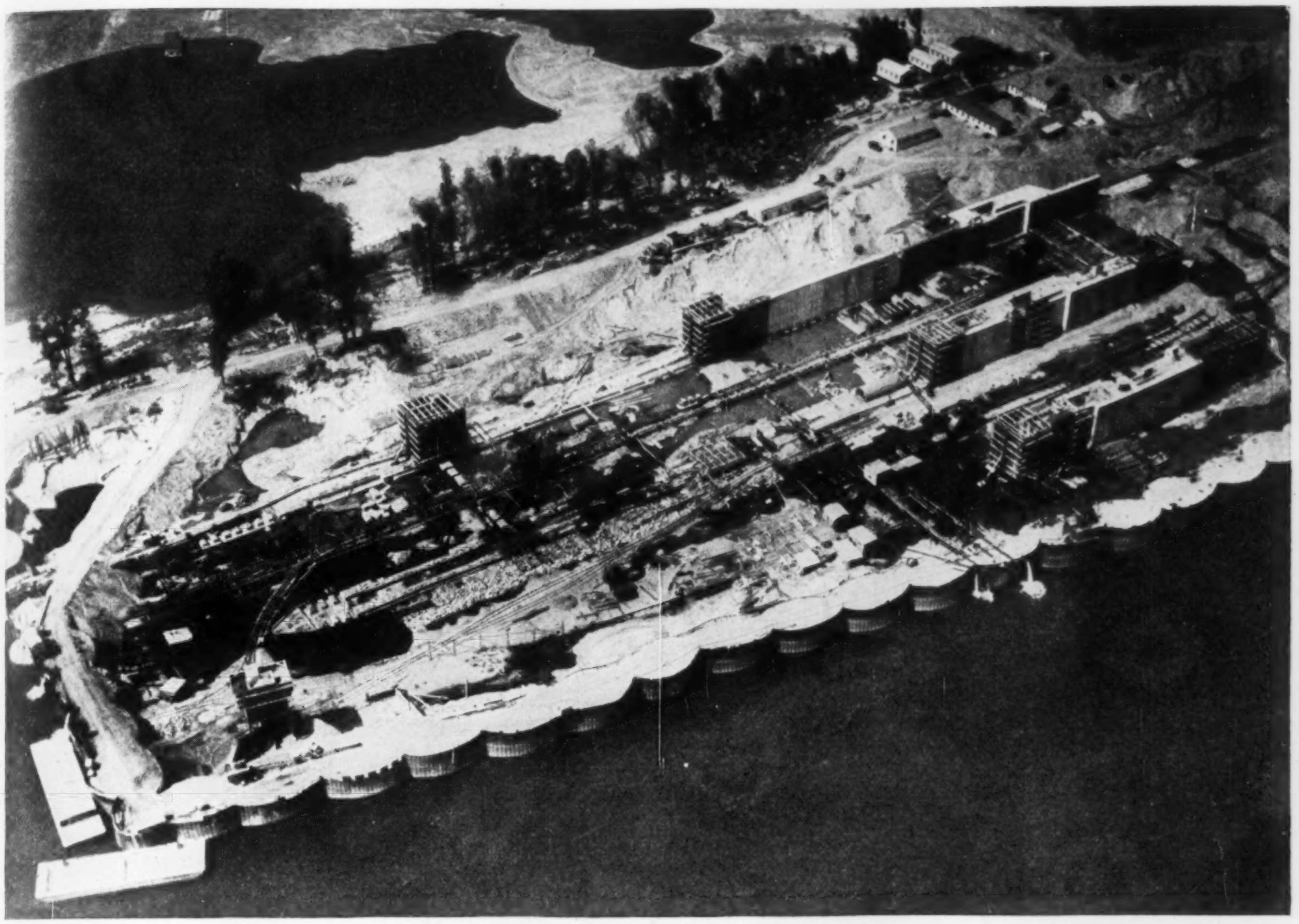

Inland Piling at Lock 25 On The Mississippi

Above: Construction photo of Mississippi Lock No. 25 at Cap Au Gris, Missouri. 2751 tons of Inland Section I-23 was used, some of the piles being 65 feet long.

This is the latest aerial photograph of the construction work underway on Lock No. 25 at Cap Au Gris on the Mississippi River.

The view clearly shows the neat tight job of Inland Steel Sheet Piling installed by the United Construction Co. United reports everything going well and work progressing splendidly.

This is but one of many successful Inland Piling jobs on the Mississippi. But Piling is only a part of the picture, for Inland Engineers work closely with the contractors from beginning to end, co-operating on design, method and construction until the job is completed.

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Contractors: Monarch Engineering Company, Inc., Buffalo, N.Y.

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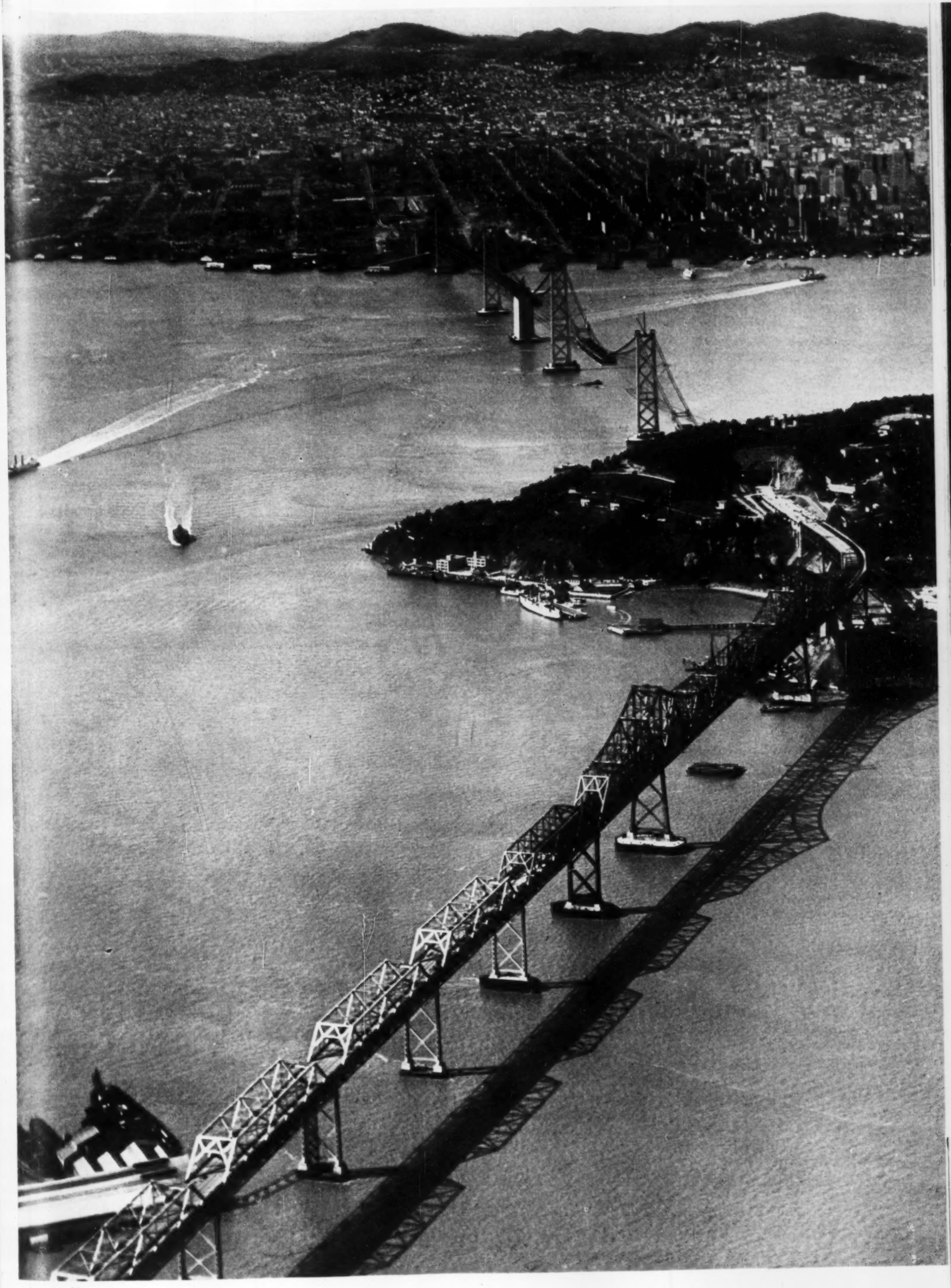

From U S Steel News

San Francisco-Oakland Bay Bridge

Dedicated November 12, 1936

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Among Our Writers

Walter D. Binger, a graduate of Massachusetts Institute of Technology, has specialized in reinforced concrete design and construction, more recently in private practice. Since 1934, he has served as deputy commissioner of sanitation for New York City. He is the author of the book *What Engineers Do*, and many engineering papers.

Richard H. Gould, after graduating from the Massachusetts Institute of Technology, specialized as a consultant in hydraulic and sanitary work, largely under the late James H. Fuertes. He was chief engineer of the Wards Island Sewage-Treatment Works at its inception in 1928, previous to installation in his present position.

E. A. Kemmler has had 33 years of experience in various kinds of municipal engineering work, including engagements at Columbus, Ohio; Muskogee, Okla.; and Akron, Ohio; the latter as director of public service. Since January 1936 he has been advisory engineer on street improvement projects in Akron.

John F. Baker, formerly engaged on investigations of the strength of rigid airships and in the British Government's Department of Scientific and Industrial Research, has been professor of civil engineering at the University of Bristol since 1933. His article on Telford's early years appeared in the November issue.

John Armitage was captain of Rugby fives at Cambridge University, 1931–1932. For the last five years he has served as editor of the London journal, *Squash Rackets and Fives*.

R. A. Moyer holds bachelor's and master's degrees in civil engineering. In 1921, after practical experience in highway location work, he became a faculty member of Iowa State College, where he has served successively as instructor, assistant professor, and associate professor. He is the author of numerous articles in the highway research field.

Theron M. Ripley spent eight years on the construction of the New York State Barge Canal. Later he had charge of a $5,000,000 construction program on the Oswego River, and for five years served as chief engineer of the Greater Motorways of Erie County, N.Y. Since 1931 he has been in private practice.

C. M. Cram, at the time of his death in October 1934, had had over 25 years of experience in river and harbor improvements, largely with the U. S. Engineer Department. Among other works he had charge of design and construction of the Rainbow pier and breakwater at Long Beach, Calif.

P. A. Jones has been employed principally by the U. S. Bureau of Reclamation, with which he has served for over 20 years. He acted as division engineer on construction of the pressure tunnel under the Yakima River, Wash., and as chief inspector at Boulder Dam.

V. L. Minear served as a captain of field artillery overseas during the World War. Since 1932 he has been assistant and associate engineer, U. S. Bureau of Reclamation, engaged principally in supervising and developing methods for the placing of 100,000 sacks of cement in pressure grouting works appurtenant to Boulder Dam.

J. K. Finch, who has been teaching engineering for some 25 years, is now head of the civil engineering department at Columbia University. He has long been interested in the broader problems of engineering education, and particularly in the development and teaching of engineering-economics.

Volume 6 Number 12

December 1936

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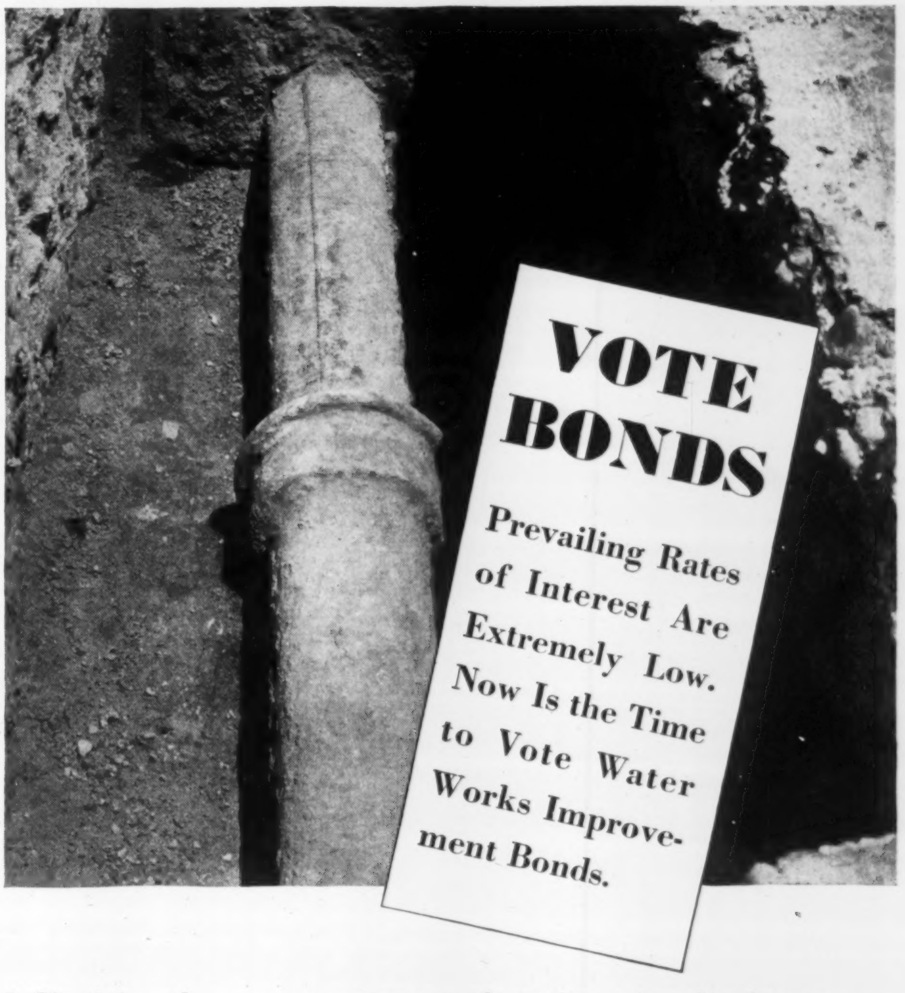
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BRIDGES

Bascule, Welding, Comparisons. Double-Track Bascule Span Employs Welded Design, H. Lawson. *Eng. News-Rec.*, vol. 117, no. 12, Sept. 17, 1936, pp. 408–409. Field welding, adopted in constructing new 54-ft bascule span for Florida East Coast Railway line at Jupiter, Fla., results in saving of 20 per cent in counterweight tonnage; comparison between welded and riveted members.

Steel Truss, Los Angeles. Vierendeel Girder Bridge Introduced in America, L. T. Evans. *Eng. News-Rec.*, vol. 117, no. 14, Oct. 1, 1936, pp. 471–472. Design of Vierendeel truss bridge, 95 ft in span with 40-ft roadway, to be built at Los Angeles.

Steel Truss, Pittsburgh, Pa. Continuity and Determinacy Combined in New Bridge. *Eng. News-Rec.*, vol. 117, no. 10, Sept. 3, 1936, pp. 328–330. Design and construction of Monongahela River Bridge between Pittsburgh and Homestead, 3,200 ft long, including Wichert steel trusses up to 533.5 ft in length, in which panel or members over piers is pin-jointed rhomboid instead of more usual triangle; jacking details required at expansion shoes on piers during erection.

Suspension, Great Britain. Chelsea Bridge. *Engineer*, vol. 162, no. 4204, Aug. 7, 1936, pp. 139–141 and 136. Bridge replaces suspension structure built in 1858; new bridge and piers situated in same position as old; although of considerably greater strength suspension cables will appear much lighter than chains of old bridge; each consists of 37 steel wire ropes, $1^7/_8$ in. in diameter, assembled together in hexagonal bundle; demolition of old bridge, foundations, and steel work described.

Suspension, Towers. Designing Bridge Towers 700 Ft High, C. E. Paine. *Eng. News-Rec.*, vol. 117, no. 15, Oct. 8, 1936, pp. 497–505. Design and construction of rigid-frame structures supporting Golden Gate suspension bridge, with span of 4,200 ft; rigorous analysis culminating in 33 simultaneous equations aided by application of Williot diagram procedure; factors that influenced design; longitudinal stresses; transverse wind stresses; refinement of preliminary design; strut depth; earthquake considerations; fabrication of towers; erection.

BUILDINGS

Steel, Straightening. Straightening Leaning Building. *Eng. News-Rec.*, vol. 117, no. 12, Sept. 17, 1936, pp. 407–408. Righting leaning steel-frame, four-story building in Chicago, which had been thrown out of plumb, some 16 in. at top, by explosion in adjacent building; method utilized inclined shores, bearing against floors.

CITY AND REGIONAL PLANNING

New England. Regional Planning—Pt III—New England. Nat. Resources Committee, Washington, D.C., U. S. Government Printing Office, July 1936, 101 pp., figs., diagrs., charts, tables. Price 30 cents. Organization of New England Regional Planning Commission; staff reports on population, land resources, recreation, water resources, transportation, industry, publicity, and planning agencies in New England. Bibliography.

Surveying. Hartford Conducts Regional Geodetic Survey, C. W. Cooke. *Eng. News-Rec.*, vol. 117, no. 13, Sept. 24, 1936, pp. 431–434. System of Hartford, Conn., covers over 100 sq miles; angle measurements; office procedure and detail; computing plane ordinates; conducting traverse; traverse computations; level nets; topographic mapping; administration.

United States, Future Problems. Looking Ahead to City Growth Problems, F. J. Klaus. *Eng. News-Rec.*, vol. 117, no. 13, Sept. 24, 1936, pp. 430–431. Deficiencies and changes in community facilities that call for attention in new period of progressive municipal development.

United States, Revival. Municipal Works Revival, E. O. Griffenhagen. *Eng. News-Rec.*, vol. 117, no. 13, Sept. 24, 1936, pp. 427–429. Recent trends indicating encouraging prospect for early resumption of large program of rehabilitation and modernization of public facilities; inventory of public works needs made by PWA in 1935; percentages of total state and municipal bond sales at various rates of interest during last 10 years; reforms in public management.

CONCRETE

Aqueducts, Lining. Canal-Lining Equipment on Los Angeles Aqueduct. *Engineer*, vol. 142, no. 3685, Aug. 28, 1936, pp. 215–217, supp. plate. Results of studies of various methods of placing concrete on bottom and sides concurrently; development of two pieces of heavy construction equipment representing distinctly new types; these are subgrader and monolithic paver or concrete finisher; internal vibrators are employed to ensure proper placing of concrete on side slopes.

Construction. Design Forms on Flood Control Project as Engineering Problem. *Concrete*, vol. 44, no. 8, Aug. 1936, pp. 5–8. Design and construction of concrete forms built of steel panels and supporting trusses used in construction of concrete enclosure for stream, 4 miles long, through Council Bluffs, Iowa, designed to be used as highway.

Construction, Bonding. La soudure et la reprise du béton dans les travaux en béton armé, E. Lemaire. *Gênie Civil*, vol. 109, no. 2823, Sept. 19, 1936, pp. 241–244. Review of French and Spanish practice and experience in joining, or bonding, of precast concrete members, using portland or alumina cements; results of laboratory tests; application of method to marine construction.

Construction, Forms. Welded Forms Speed Construction of 16-Ft Water Tunnel. *Welding Engr.*, vol. 21, no. 8, Aug. 1936, pp. 28–29. Illustration showing 20-ft collapsible concrete form for Los Angeles water tunnel, of which 300 ft of sections was assembled by welding.

Construction, Research. Neuere Untersuchungen mit Zement und Beton zu grossen und wichtigen Bauwerken, etc., O. Graf. *VDI Zeit*, vol. 80, no. 37, Sept. 12, 1936, pp. 1129–1134. Recent studies on cement and concrete for large construction work, with special regard to concrete highway bridges and dams; notes on selection of cement and its testing; granular structure of concrete admixtures; pouring of concrete; properties of concrete.

Reinforcement, Bamboo. Versuche ueber die Verwendung von Bambus im Betonbau, K. Datta. *Bauingenieur*, vol. 17, nos. 3/4, Jan. 24, 1936, pp. 17–27. Results of laboratory tests, made at Stuttgart Institute of Technology, on strength of concrete reinforced with insulated and non-insulated bamboo rods, having tensile strength of 1,600 to 2,100 kg per sq cm; compression, tension, and bond tests of reinforced prismatic specimens and model beams; rules for use of bamboo reinforcement. Bibliography.

Tanks. Metal Lining Improves Concrete Tanks. H. E. Weightman. *Chem. & Met. Eng.*, vol. 43, no. 7, July 1936, pp. 373–374. Proper design of concrete tanks and method of applying lining of lead, stainless steel, nickel, or other metal sheets.

DAMS

Alcova Dam. Grouting Seals Alcova Dam. *Eng. News-Rec.*, vol. 117, no. 10, Sept. 3, 1936, pp. 323–327. Preparing sandstone foundation of coreless earth dam 222 ft high; 10 miles of grout holes sunk into water-bearing foundation rock to form blanket and curtain walls; cutoffs of concrete built above rock surface with curtains of grouted rock below to stop seepage under compacted earth-fill section of dam; stripping of site.

Bonneville, Repair. Jetty Construction Methods Used to Repair Bonneville Cofferdam. *Eng. News-Rec.*, vol. 117, no 14, Oct. 1, 1936, pp. 461–463. Methods considered for repairing breach caused by flood in Bonneville cofferdam; rock up to 30 tons in weight dumped from trestle to close breach.

Grand Coulee Dam. Program for Grand Coulee's Second Cofferdam. *Eng. News-Rec.*, vol. 117, no. 14, Oct. 1, 1936, pp. 464–466. Outline of design for construction of U-section cribs to permit gradual closure with stoplogs; cribs of different design in upstream and downstream arms; unwatering of present river channel set for latter part of December.

Hydraulic Fill, Montana. Fort Peck Dam Today—III. Enlargement and Lining, H. W. Richardson. *Eng. News-Rec.*, vol. 117, no. 7, Aug. 13, 1936, pp. 238–243. Ingenious adaptation of top heading and bench method overcomes difficult problem of enlarging large bores in treacherous shale; lining follows close behind excavation.

Research, United States. Hydraulic and Structural Work at Case School, G. E. Barnes and F. L. Plummer. *Eng. News-Rec.*, vol. 117, no. 11, Sept. 10, 1936, pp. 365–367. Research facilities and research projects carried on in civil engineering department of Case School of Applied Science, including tests of models of constricted outlet channel from Wards Island (New York) sewage-plant grit chambers; outlet works of Pleasant Hill Dam; outlet works of Charles Mill Dam of Muskingum Valley project; long span, two-hinged steel arch bridge.

Reservoirs, Leakage. Zur Frage der Dichthaltung und kuenstlichen Abdichtung von Speicherbeckon, J. Stiny, K. Kuhn, and A. Winter. *Wasserwirtschaft u Technik*, vol. 3, nos. 24–25, Aug. 25, 1936, pp. 234–235. Contribution to problem of preventing leakage in storage reservoirs; results of laboratory experiments at Vienna Institute of Technology, showing that leakage of natural reservoirs decreases with increase in depth and hydrostatic pressure of stored water.

Reservoirs, Silt. Ueber die Gefahr der Versandung und Verschotterung, der Bergstuerze oder Gletscherrutsche fuer den Bestant von Staubecken und die Sicherheit der Sperrmauern, E. Mattern. *Wasserwirtschaft u Technik*, vol. 3, nos. 24–25, Aug. 25, 1936, pp. 242–248. Summary of data, principally German and Austrian, on effect of landslides and glacier flows on silting and filling up of reservoirs on higher altitude with debris, endangering safety of dams. Bibliography.

Rock-Fill. San Gabriel Dam No. 1, M. Wharton. *Explosives Engr.*, vol. 14, no. 8, Aug. 1936, pp. 227–234 and 246. Nature of project; design of dam; large-scale quarrying operations.

Spillways, Construction. Fort Peck Dam Today—V. Spillway Gates and Channel Paving, H. W. Richardson. *Eng. News-Rec.*, vol. 117, no. 9, Aug. 27, 1936, pp. 295–299. Design and construction of spillway, 9,700 ft long, having capacity of 255,000 cu ft per sec, with bottom width varying from 130 to 800 ft; steel erection; paving spillway; concrete placing.

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FLOOD CONTROL

China. Possibility of Yellow River Flood Control by Means of Detention Basins, S. Eliassen. *Assn. Chinese & Am. Engrs.—J.*, vol. 17, no. 4, July–Aug., 1936, pp. 211–230, 5 supp. plates. Plan for controlling floods on river with possible discharge of 25,000 cu m per sec; physiographic and geological description of Meng Tsin Shanchow region; channel capacity through diked section; Pa Li Hu T'ung and San Men dam sites; back-water influence; deterioration of reservoir due to silting; destructive velocities; effect of control on river bed in plain. (In English.)

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ROADS AND STREETS

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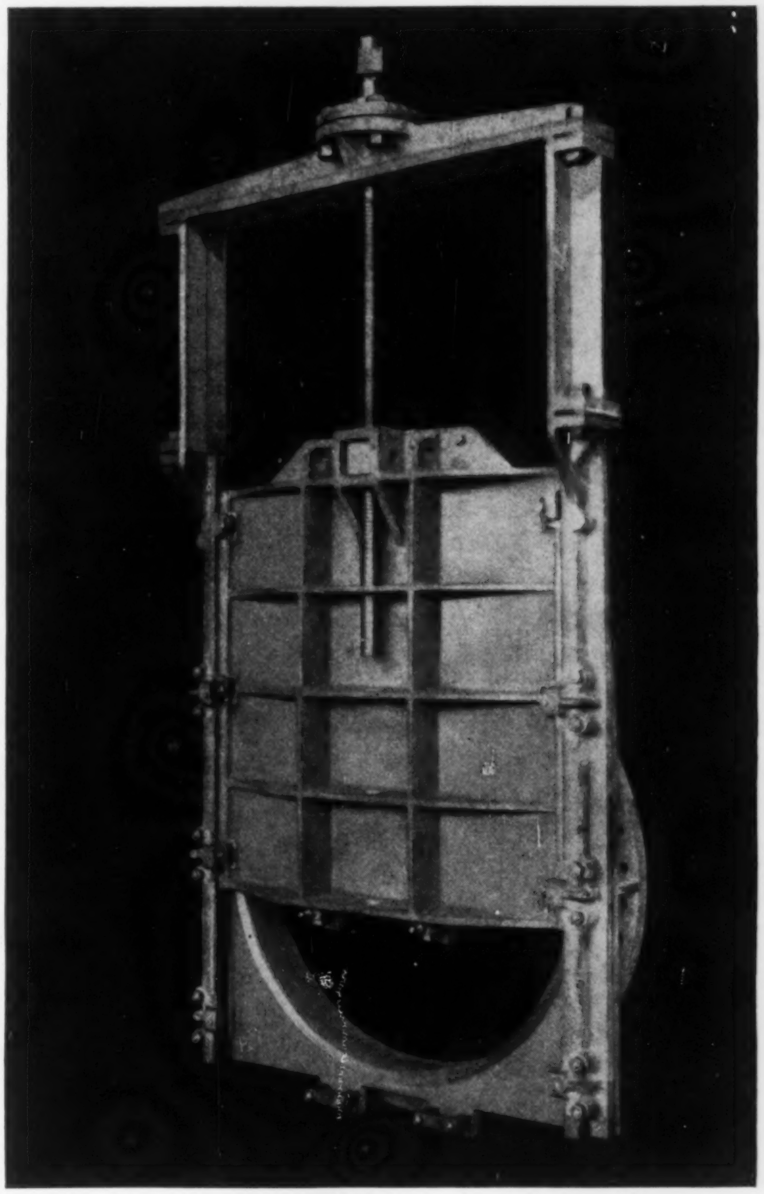

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Water Pollution, Wisconsin. Clean Streams for Wisconsin. *Eng. News-Rec.*, vol. 117, no. 9, Aug. 27, 1936, pp. 310–316. Program of pollution abatement started 10 years ago has resulted in marked progress in construction of sewage treatment facilities on major watersheds; developments in trade waste treatment; activity on major watersheds; malt-house wastes; cannery wastes; pulp and paper mill wastes; tannery wastes.

STRUCTURAL ENGINEERING

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Framed Structures, Concrete. Analysis of Monolithic Structures by Transmission Coefficients—IV, F. Shapiro. *Concrete*, vol. 44, no. 8, Aug. 1936, pp. 12–14. Example of application of method to analysis of rigid-frame building.

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Retaining Walls, Stability. Die Beurteilung der Kippsicherheit von Stuetzmauern als Labilitaetserscheinung, H. Craemer. *Zement*, vol. 25, no. 4, Jan. 23, 1936, pp. 52–56. Determination of stability of retaining walls; methods of calculating resistance to overturning critically discussed.

Statically Indeterminate Structures, Design. Vereinfachtes Verfahren zur Berechnung statisch unbestimmter, durchlaufender und beliebig eingespannter, balkenartiger Tragwerke mit beweglicher Belastung, A. Kleinlogel, K. Hajnal-Kónyi, and A. Haselbach. *Beton u Eisen*, vol. 34, nos. 22, 23, and 24, Nov. 20, 1935, pp. 353–360; Dec. 5, pp. 370–375; and Dec. 20, pp. 383–392. Theoretical mathematical discussion of simplified method of design of statically indeterminate continuous beam structures variously stressed by moving loads; determination of limiting values of moment and shear; evaluation of influence lines; numerical examples.

TUNNELS

Aqueducts, Colorado River. Power Loading on Colorado River Aqueduct, A. C. Green. *Am. Inst. Min. & Met. Engrs.—Tech. Publ.*, no. 729, mtg. Feb. 1936, 20 pp. Projected 241-mile aqueduct includes 91 miles of 16-ft tunnel; outline of tunnel-driving practice; features of large Conway mucker designed to meet requirements on this project; labor costs; wage scale; car change systems used; drilling and blasting; concreting; ventilation; haulage.

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Railroad, Lowering. Lowering Tunnel Floor Under Traffic. *Ry. Eng. & Maintenance*, vol. 32, no. 6, June 1936, pp. 358–363. Difficulties experienced by Pennsylvania Railroad in lowering floor of 3,800-ft Virginia Avenue Tunnel at Washington, D.C., from 236 to 54 in. to provide enlarged clearances required by electrification.

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Vehicular, Switzerland. Una galleria attraverso il S. Gottardo per il traffico automobilistico. *Rivista Tecnica della Svizzera Italiana*, vol. 25, no. 8, July–Aug., 1936, pp. 73–81. Outline of project for construction of vehicular tunnel under St. Gottard Pass in Swiss Alps as part of international highway system from Italy into Germany and France; geology of site; prospective traffic volume; ventilating scheme; estimated cost 80,000,000 Swiss francs.

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(1936) of the *Proceedings* of the High-
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conducted at Iowa State College in
operation with the Highway Res
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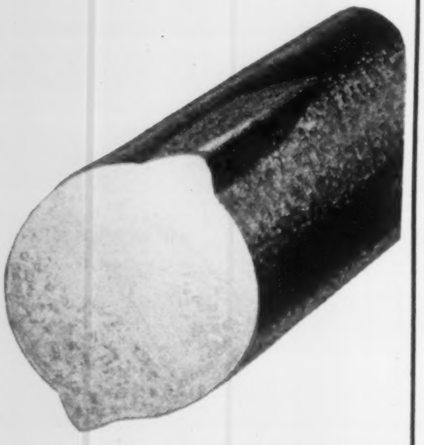
With 50,000 pounds elastic limit in every square inch of rail steel higher stresses are sound engineering practice. Specify A. S. T. M. A16-35 or Federal Specification QQ-B-71.

Information:

Rail Steel Bar Association
Builders Building, Chicago



RAIL STEEL
for concrete reinforcing

WATER PIPE LINES

CONCRETE, EARTH PRESSURE. Die Beanspruchung von Rohren durch ihre Ueberschuettung, F. Koegler. *Gesundheits-Ingenieur*, vol. 59, no. 7, Feb. 15, 1936, pp. 95–99. Report from Soils Laboratory of Freiburg, Germany, on experimental study of stresses produced by back fill on concrete pipes; review of previous studies, mostly American and German.

WATER RESOURCES

CONFERENCE REPORTS. Soil and Water Conservation. *Eng. News-Rec.*, vol. 117, no. 14, Oct. 1, 1936, pp. 478–480. Proceedings of Washington Upstream Engineering Conference, held in September 1936, including papers and discussions by M. L. Cooke, T. Saville, W. C. Lowdermilk, E. H. Clapp, H. H. Bennett, E. M. Markham, R. E. Horton, W. N. White, G. S. Knapp, G. D. Clyde, E. R. Jones, and S. M. Woodward on soil erosion, types of flood control, surface runoff control, weather cycles, farm ponds in Kansas, use of small dams, safe construction, small dams and floods, malaria control, and administrative problems.

UNITED STATES. Some Recent Federal Activities in Conservation of Water Resources, A. Wolman. *Am. Water Works Assn.—J.*, vol. 28, no. 9, Sept. 1936, pp. 1252–1282, (discussion) 1282–1292. Organization and work of 35 government agencies; origin and personnel of Water Resources Committee; resolution of conflict drainage and water storage; water pollution; balanced river regulation; problems of arid and semi-arid West; water-works statistics; standard practice; Kansas City flood protection; drainage-basin economics.

UNDERGROUND, TESTS. Thiem Method for Determining Permeability of Water-Bearing Materials and Its Application to Determination of Specific Yield, L. K. Wenzel. *U. S. Geol. Survey—Water-Supply Paper 679-A*, 1936, 57 pp, 6 supp. sheets. Price 10 cents. Results of two pumping tests near Grand Island, Nebr., to ascertain accuracy of Thiem method and to investigate possibilities of determining specific yield by pumping; hydrology of water-bearing formations; development and confirmation of Thiem's formula; formula of cone of depression; graphic solution of Thiem's formula.

UNDERGROUND, THEORY. Movement of Underground Waters, with Remarks on Radioactive Waters and Mineral Springs, C. S. Fox. *Min. & Geol. Inst. India—Trans.*, vol. 30, pt. 2, Feb. 1936, pp. 125–133. Review of theories on porosity and percolation, solution and subsidence, removal of silica, water in subcapillary pore spaces, influence of faults on underground water, mineral and radioactive waters, earthquake effects on springs, mineral water in irrigation, and similar subjects.

WATERSHEDS, PROTECTION. Watershed Protection and Control, G. M. Irwin. *Am. Water Works Assn.—J.*, vol. 28, no. 8, Aug. 1936, pp. 1075–1089. Watershed restrictions; Province of British Columbia Health Act; conservation; forests and stream flow; erosion.

WATER TREATMENT

COAGULATION, TENNESSEE. Improved Coagulation Produces Increased Efficiency and Economy, W. J. Eldridge. *Water Works & Sewerage*, vol. 83, no. 7, July 1936, pp. 257–260. Benefits derived from better mixing and coagulation at plant of Du Pont Rayon Company, Old Hickory, Tenn., where alum was used as coagulant; description of flocculator and sludge removal mechanism. Before Am. Water Works Assn.

FILTRATION. Experimental Determination of Depth of Filter Bed Sand, M. H. Thomson. *Can. Engr.*, vol. 71, no. 5, Aug. 4, 1936, pp. 3–5 and 11. Results of experiments made during 1934–1935 at Albany, N.Y., to determine relationship of sand size to necessary depth of sand to produce good filter effluent.

FILTRATION PLANTS, FORT SMITH, ARK. Filter Plant for Fort Smith Treats New Mountain Supply. *Eng. News-Rec.*, vol. 117, no. 12, Sept. 17, 1936, pp. 400–402. Unusual features of filtration plant of Fort Smith, Ark., including clear-water reservoir with multiple-arch walls and buttresses, perforated wall inlets, and outlets to settling basin, etc.; head in flow line from reservoir generates power in plant to operate filters; paddle mixers and controlled flow through settling basins furnish proper pretreatment; total cost $175,000.

WATERSHEDS, FORESTRY. Forests and Water Aspects Which Have Received Little Attention. J. Kittredge, Jr. *J. Forestry*, vol. 34, no. 4, Apr. 1936, pp. 417–419. Original suggestions of possibilities of increasing water yield by forest management, with special reference to conditions in California; transpiration, interception, and evaporation in relation to precipitation and runoff.

WATER WORKS ENGINEERING

HARTFORD, CONN. Water Supply of Hartford Metropolitan District, C. M. Saville. *Conn. Soc. Civ. Engrs.—Annual Report*, 1935, pp. 97–147, 10 supp. sheets. History of water works of Hartford, Conn., serving population of over 200,000; design and construction of concrete-core earth-fill dam at Berkhamsted, having maximum height of 137 ft; population and water consumption statistics; rainfall, runoff, and flood records; design of spillway; specifications for dam construction.

MODERN METHODS. Los Angeles Convention Big Success. *Water Works Eng.*, vol. 89, no. 13, June 24, 1936, pp. 832–836. Proceedings of annual convention of Am. Water Works Assn., with brief abstracts of following papers: Experience with Automatic Control Equipment at Pumping Stations, H. A. Harris, Jr.; Modern Air Conditioning: What It Means to Water Utility, L. L. Lewis and L. H. Polderman; Operating Experiences in Water Supply at Waco, Tex., G. L. Rohan.

NEW JERSEY. History of Development of Use of Water in Northeastern New Jersey, C. H. Capen, Jr, *Am. Water Works Assn.—J.*, vol. 28, no. 8, Aug. 1936, pp. 973–982. History of utilization of water resources of New Jersey since 1730; Morris Canal and water power; first large water supplies; first state commission; later developments by cities; Passaic River floods; second state water supply commission; Wanaque supply; Ramapo case; post-war developments; existing agencies; future problems. Before N. J. Water Works Assn.

PUBLIC WORKS, CHINA. Public Works in Peiping, C. C. Chang and P. H. Tan. *Assn. Chinese & Am. Engrs.—J.*, vol. 16, no. 4, July–Aug., 1935, pp. 193–204. Present activities and plans for future; streets; water supply; Peiping Public Water Works; tapping Sun Ho; filter-beds; pressure and distribution; public wells; sewerage system; sewerage planning; improving old drainage; new sewerage system. (In English.)

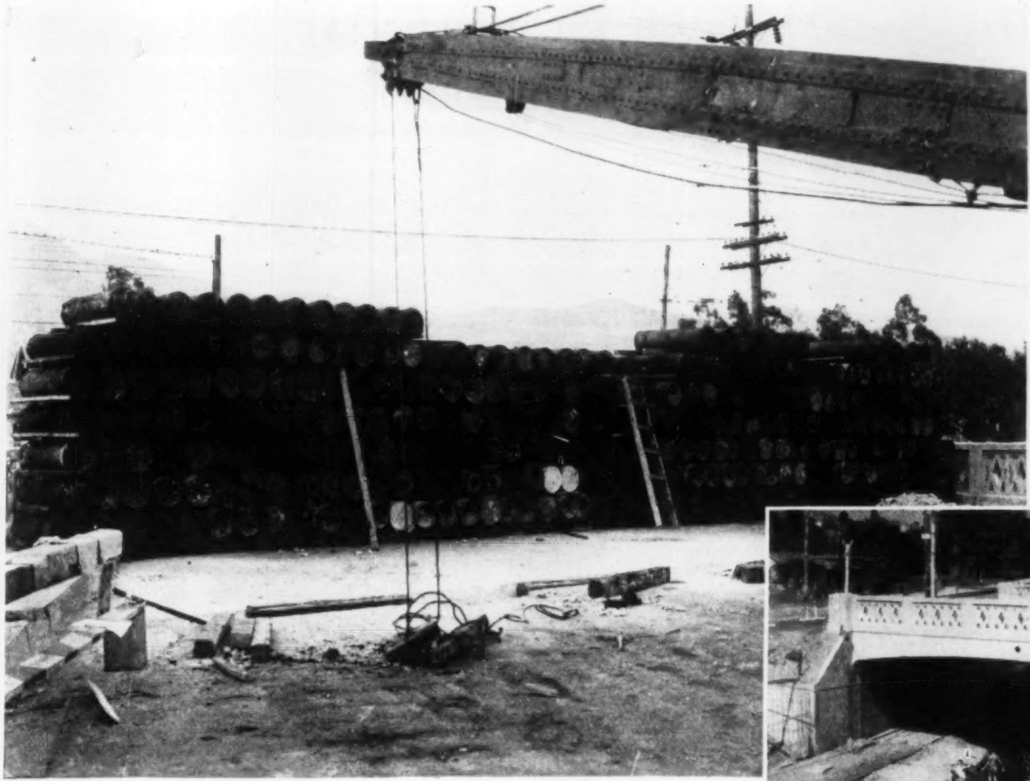
SAN FRANCISCO. Benefits Accruing from Hetch Hetchy Project, San Francisco Water Supply, N. A. Eckart. *Am. Water Works Assn.—J.*, vol. 28, no. 9, Sept. 1936, pp. 1211–1229, (discussion) 1229–1231. Review of development and benefits of Hetch Hetchy water supply for San Francisco, Calif.; considerations determining selection of Hetch Hetchy; description of project; improved sanitary and physical characteristics; chemical qualities; electric power supply; operating benefits; indirect benefits.

TESTS. A. W. W. Purification Division Discusses Tests and Analyses, L. V. Carpenter. *Water Works Eng.*, vol. 89, no. 14, July 8, 1936, pp. 903–906. Brief abstracts of following papers presented at 56th annual convention of Am. Water Works Assn.: Methods of Testing and Significance of Boron in Water Supplies, R. L. Derby; Methods of Testing and Significance of Fluorine and Fluorides in Water Supplies, J. M. Sanchis; Plankton and Insect Larvae Control in California Waters, G. E. Arnold; Iron and Manganese Removal by Zeolites and Manganese Zeolite Processes, E. Nordell; Use of Beds of Manganese in Iron and Manganese Removal, W. G. Kirchoffer; Analytical Control of Anti-Corrosion Treatment, W. F. Langelier; Mixing, C. M. Hoskinson; Coagulation, K. W. Brown; Filter Design as Related to Operation, H. N. Jenks; Filtration Without Preliminary Coagulation, J. DeCosta; Maintenance of Filtration Plant Equipment, J. Perhab.

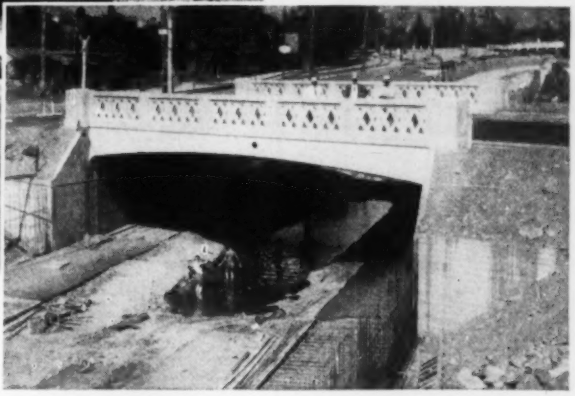
TOWERS, MOVING. Steel Water Tank on Tall Tower Moved 350 Ft to New Location, M. C. Shedd. *Eng. News-Rec.*, vol. 117, no. 7, Aug. 13, 1936, pp. 236–237. Method of moving 75,000-gal water tank on 25-ft steel tower near Los Angeles harbor; base rigidly braced with timbers; counterweights added to framework to offset 50-mile wind pressure increased load from 65 to total of 160 tons.

TYPHOID FEVER. Decline of Typhoid, M. N. Baker. *Eng. News-Rec.*, vol. 117, no. 12, Sept. 17, 1936, pp. 397–399. Analytical summary of progress and problems of typhoid control in American cities during last quarter-century, emphasizing influence of improved water supplies on public health; factors affecting decline; uncertainties in statistics; paratyphoid and typhoid deaths, 1931–1935; classified typhoid death rate per 100,000 population for 93 largest American cities.

WELLS. Critical Analysis of Gravel-Packed Wells, H. L. White. *Water Works Eng.*, vol 89, no. 17, Aug. 19, 1936, pp. 1077–1080. Faults observed in wells by author; alignment variation and control; methods of improving well design and construction. Before Am. Water Works Assn.



700 automobiles make a huge pile, but cause no greater stress than the steel ingots placed on the center of the span. Central Ave. bridge was designed and built under the direction of Glendale's City Engineer J. C. Albers, and C. D. Ament and Walter L. Dickey, members of his staff. Test conducted under the supervision of council consisting of Prof. F. J. Converse, head of California Institute of Technology Laboratories; C. D. Wailes, district structural engineer for the Portland Cement Association; Walter L. Dickey, graduate of California Institute of Technology and L. T. Evans of the Army Engineers field staff. Other groups loaned the services of leading engineers as well as many delicate instruments and gauges.



4 times the design load produced only 3/8" deflection in this skew RIGID FRAME CONCRETE BRIDGE

Widening of the Arroyo Verdugo flood control channel near Glendale, California required the demolition of several relatively new concrete bridges—and provided a unique opportunity to put the strength of rigid frame concrete construction to the test.

The bridge selected for the test was the Central Avenue project having a clear span of 43 feet and a skew angle of 25 degrees 34 minutes. Work was carried on under the supervision of a council composed of a group of the country's outstanding engineers. Here's what was done.

Three-thousand-pound steel ingots were placed on the center of the bridge until the total load was 440 tons, approximately equivalent to *700 automobiles* spread across the bridge—four times the H-20 design load for the structure. Yet deflection at the center of the span was only 3/8 of an inch; considerably less than the minimum required to cause hairline cracks. Examination of sections and cores during the subsequent demolition of the bridge showed no damaging effects from the overload.

Shallow bridge floors, unimpeded flow of traffic, good visibility, strength, permanence and economy are all reasons why you should consider rigid frame concrete construction for your next bridge. You'll find much helpful information in our free booklet, "Analysis of Rigid Frame Concrete Bridges."

PORTLAND CEMENT ASSOCIATION

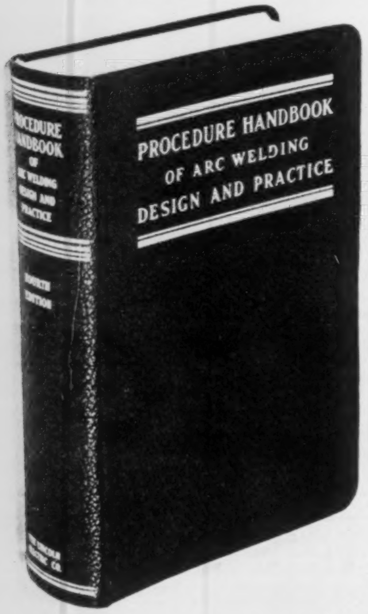
Dept A12-13 33 W. Grand Avenue, Chicago, Illinois

Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

Lincoln Announces New Enlarged Edition of Arc Welding Handbook

The Lincoln Electric Company, Cleveland, Ohio, announce reissue of the "Procedure Handbook of Arc Welding Design and Practice" in greatly enlarged form. The new handbook, now in fourth edition, contains 223 added pages of new arc welding data and 289 new illustrations, including photos and drawings. The volume now contains 819 pages and 990 numbered text illustrations.



New data presented in the Procedure Handbook includes complete information on the following subjects: Characteristics of the Welding Generator—Selection of Type of Joint—Insurance of Fusion Welded Vessels—Welding Codes—Arc Cutting—Polarity of Welding Current—Horizontal Welds—Sheet Metal Welding—Effect of Electrode Size on Welding Cost—Methods of Testing Weld Metals—4-6 Chrome Steel—Monel Metal—Principles of Surfacing by Welding—Welded Design Begins with Standard Shapes and Plates—Plate Girders.

In addition to containing the above new data, the handbook has been thoroughly revised in all its departments in light of present-day arc welding practice. The handbook is reported to be a complete reference guide for all who are interested in arc welding. Written especially for use of designers, engineers, welding supervisors, and operators, this handbook contains a wealth of data of interest to draftsmen, steel fabricators and erectors, cost estimators, maintenance managers, piping and pipe line contractors, and students of welding.

The eight sections of the book cover the following subjects: Part I—Welding Methods and Equipment; Part II—Technique of Welding; Part III—Procedure, Speeds, and Costs for Welding Mild Steel; Part IV—Structure and Properties of Weld Metal; Part V—Weldability of Metals; Part VI—Designing for Arc Welded Steel Construction of Machinery; Part VII—Designing for Arc Welded Structures; and Part VIII—Typical Applications of Arc Welding in Manufacturing, Construction, and Maintenance.

Procedure Handbook is $5^3/_4$ by 9 ins., an ideal size for desk or shop use. The binding is semi-flexible simulated leather, gold embossed. Copies will be mailed, post paid, in the United States for $1.50 per copy. Outside United States—$2.00.

New Clay Diggers

The Independent Pneumatic Tool Company recently announced their new Thor No. 401 and No. 402 clay diggers. The important feature of these tools is reported to be the new Thor pigtail rubber bumper. This spiral bumper fits around the shank of the spade as well as inside the retainer, forming an effective packing that prevents dirt or gravel from entering.

The No. 401 clay digger is especially adapted for tunnel work, being light, powerful, and capable of standing the rough usage to which tools of this nature are subjected. The No. 402 clay digger can be used in caissons and large tunnels where the ground is especially hard. It has plenty of power and with chisel point can be used for light demolition work.

Low Range D-C Arc Welder

A new departure in arc welding, a low-range, direct-current welder, utilizing rectifier bulbs instead of rotating equipment, is announced by the General Electric Company. The welder, designed to operate on three-phase, 50 or 60 cycle power, 230, 440, or 550 volts, uses four mercury-Tungar bulbs.

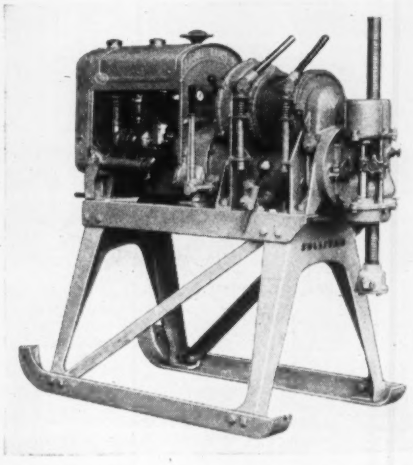
The new welder has ample capacity for welding light-gauge car or truck parts in construction and maintenance work and can be used to fabricate metal roofs, blower and ventilating systems, and steam fittings. The new welder has a current range of from 25 to 75 amperes, controlled by a nine-point tap switch. The equipment is mounted on hard-rubber casters for easy moving. Overall dimensions are 27 in. by 24 in. by 14 in. It weighs 140 lb net.

Improved Steam Turbine for Mechanical Drives

For driving general purpose machinery in industrial plants and auxiliary equipment in generating stations, a new and improved line of Type "C" turbines is announced by Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. The turbines are of the impulse type having one pressure and two velocity stages. They are built in capacities ranging approximately from 5 to 500 hp, at turbine speeds of 1,000 to 5,000 rpm. Suitable for use with steam pressures up to 650 lbs gage and for total temperatures up to 750 deg F, they may be operated either condensing or non-condensing with rotation in either direction. It is reported that these turbines are particularly adapted to driving pumps, forced and induced draft fans, compressors, pulp beaters, pulverizers, line shafts, and similar apparatus; either direct connected or through gear or belt drive.

Fast and Light Core Drill

Smallest of the Sullivan Family of core drills, the new No. 12 has a 50 per cent increase in drilling speed. This adaptable light weight machine is 4 ft 7 in. high and weighs little over a thousand pounds.



Four compact parts—hoist, engine, swivelhead, and frame—can be quickly dismantled for easy transportation. Reserve strength is built into every part to overcome any possibility of breakdown. Hydraulic or screw feed swivelhead which can be set for drilling at any desired angle. Variable speeds make efficient operation possible in either soft or hard formation. Gasoline or electric drive. Bulletin D-10. Sullivan Machinery Company, Michigan City, Indiana.

STEEL PLATE CONSTRUCTION

For many years our organization has specialized in the fabrication and erection of elevated steel tanks and steel storage tanks of all kinds. We are also equipped to build field erected steel plate structures.

Typical installations include stove shells for blast furnaces, smokestacks, bins for handling materials, agitator shells and bubble towers for oil refineries, barges, creosoting cylinders, pulp digesters, steel pipe for water supply or power projects and many other types of structures.

Our nearest office will be glad to submit quotations on field erected steel plate work without obligation to you. Whenever possible, please submit complete plans and specifications for use in making estimates.

The above illustration was photographed at the Inland Steel Company's plant in Indiana Harbor, Ind. The stove shell in the center background was being completed by our erection crew at the time the photograph was made. It is 24 ft. in diameter and 100 ft. high.

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Chicago....2199 Old Colony Bldg.
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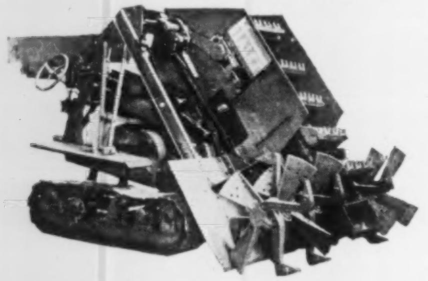
Dallas..1485 Dallas Athletic Club
Houston.........2919 Main Street
Tulsa.......1647 Thompson Bldg.
Birmingham.....1596 N. 50th St.
San Francisco...1084 Rialto Bldg.
Los Angeles..1456 Wm. Fox Bldg.

B-477

Plants in BIRMINGHAM, CHICAGO and GREENVILLE, PENNA.

Tunnel Type Excavator

A new type excavator has been developed by George Haiss Manufacturing Company, New York, for low headroom conditions, as in tunnel driving, cutting underpass excavations through railroad embankments, under-trestle digging and the like. It employs the straight line action of a bucket elevator type machine.



The digging action centers in the revolving picks and paddles carried on the extended tail shaft. Powered by the driving force of a large motor, this digging-feeding device will handle muck, clay, gravel, and soft shale and pass $1^1/_2$ to $1^3/_4$ cu yds of material a minute to the bucket elevator. This in turn discharges onto a short belt conveyor with a 5 ft reach beyond the chassis frame, affording full room for a muck car in tunnel work. Other discharge designs accommodate different working conditions.

For work in sticky ground, clay, etc., the machine is provided with a patented bucket clean-out scraper. This is synchronized in action with the passage of the buckets up the elevator and, at the discharge point, several alloy steel fingers reach down inside the bucket and mechanically break the film of adhesion by which clay might stick in the bottom. This device swings out of the way when not required.

This Haiss machine will excavate a bench cut up to 48 in. deep and will handle boulders up to six inches diameter. When a big rock or other overload is encountered, the machine is protected from breakage by a lugging type overload release clutch. The machine pictured is electric motor drive, and is of 8 ft. overall height by 8 ft extreme width. It is self-propelling on creeper treads. In digging, it is crowded into the work by a slow speed worm drive, to exert continuous positive pressure. Picks and paddles are of manganese steel. So are the buckets. Pick points are reversible, then renewable, as are also the bucket teeth. The digging level can be raised or lowered in relation to the creeper treads while the machine is operating—thus making it simple to hold a grade. The design of the machine provides for knock down handling in passing the machine down a shaft.

Pneumatic Concrete Placer

A pneumatic concrete placer has just been placed on the market by the Ransome Concrete Machinery Company, Dunellen, New Jersey. The machine is manufactured in quarter-yd, half-yd, and one cu yd capacities.

This pneumatic placer is used for placing of concrete by pneumatic pressure. Mixed concrete is charged into the charging opening after which a horizontal sliding door operated by compressed air is forced against a machined seat, sealing the intake opening. A worm feed in the bottom of the cylindrical receptacle forces the concrete into the discharge chamber where applied air carries the batch of concrete through the pipe line to the point of deposit. This worm, made of special heat treated steel, is furnished with renewable wearing sleeves on the shaft, and is driven by an Ingersoll-Rand type HH air motor through a reduction gearing.

It is claimed that due to the worm feed construction only a minimum amount of air is required to move the concrete—number of blocks in discharge line are materially reduced—and output is increased for given sizes.

All control levers center at the operator's position adjacent to the charging door so that one operator from his operating position controls the air motor, the charging door, and the air valves used for the discharge of the batch of concrete.

Detailed information about the machine, which is said to be fully covered by patents, may be secured from the Ransome Concrete Machinery Company.

Concrete Vibration

A concrete vibrator, specially designed for the placement of concrete in dams, large bridge piers, abutments, footings, and other mass structures, has been announced by the Chicago Pneumatic Tool Company, New York, N.Y. In this new unit, the motor is placed at the upper end of the short tube connecting it to the vibrator tube. This is reported to improve balance and to make the vibrator easier to handle.

Folders Announced

All-Welded Dippers—A new four-page bulletin, gives full details, specifications as to construction, and the weight-saving advantages of these dippers. Bulletin D-6, $8^1/_2$ by 11 in. Harnischfeger Corporation, Milwaukee, Wisconsin.

Arc Welding—The New Arc Welding Technic is the title of a generously illustrated and informative booklet recently published. $8^1/_2$ by 11 in., 20 pages. Lincoln Electric Company, Cleveland, Ohio.

Automatic Sewage Regulators—Three bulletins, Nos. 52, 53, and 54 describe and illustrate the 19 stock sizes of gates furnished, and the 3 distinct types of control. A fourth bulletin, No. 55, is a report of tests made at Ohio University to determine the coefficient of discharge through regulator gate tubes. $8^1/_2$ by 11 in., and from 2 to 8 pages. Brown & Brown, Inc., Lima, Ohio.

Centrifugal Pumps—The Mixflo centrifugal pump, in sizes from 12 to 84 in., delivers from 1000 to 225,000 gal per min at heads from 5 to 50 ft. It is widely used for irrigation, drainage, sewage disposal and condenser circulation service. Bulletin W-313-B1 contains a complete description of the parts of the pumps, together with technical information concerning modern trends in hydraulic design. Photographs, sectional drawings and dimension tables are also included. $8^1/_2$ by 11 in., 8 pages. Worthington Pump and Machinery Corporation, Harrison, New Jersey.

Concrete Vibrators—A booklet—Instructions for Placing Concrete with Mall Concrete Vibrators, $5^1/_2$ by $8^1/_2$ in., 12 pages, with illustrative diagrams—and a 4 page, $8^1/_2$ by 11 in., folder—Ten Questions to ask when buying a Concrete Vibrator are offered on this subject by the Mall Tool Company, 7740 So. Chicago Ave., Chicago, Illinois.

Construction Equipment—A new, 24-page bulletin, WP-1061, showing their equipment for contractors is offered by Worthington Pump and Machinery Corporation. This bulletin shows power, compressed air, drilling, pumping, and miscellaneous equipment on the job and in the shop. $8^1/_2$ by 11 in., with illustrations of many types of contractors equipment. Worthington Pump and Machinery Corporation, Harrison, N.J.

Coupled Pumps—Bulletin No. 7066 covers the line of pumps of capacities from 150 to 5,000 gpm against heads of 20 and 250 ft. $8^1/_2$ by 11 in., 16 pages, with illustrations of construction details and pump installations. Ingersoll Rand Company, 11 Broadway, New York, N.Y.

Dragline Buckets—P & H Dragline Buckets, $^3/_4$ to 4 cu yds, Bulletin D4, $8^1/_2$ by 11 in., 4 pages, illustrated. Harnischfeger Corporation, Milwaukee, Wis.

Fireproofed Wood—The facts on the fireproofing of lumber are given in literature available from two sources: Fire-Retardant Treatments for Wood, Bulletin No. 46, and the more recently published bulletins of the Protexol Corporation, Kenilworth, N.J.; and the Report on Fireproof Red Oak, and Maple Lumber for Flooring and Interior Finish, Report R 2282 of the Underwriters Laboratories of the National Board of Underwriters Chicago, Illinois.

Power Control Units is the title of a 12 page, $8^1/_2$ by 11 in., illustrated folder, describing the power control units which operate all Le Tourneau equipment. R. G. LeTourneau, Inc., Peoria, Illinois.

Road Graders—Bulletin No. 1617 describes and illustrates the line of Austin-Western Road Graders. $8^1/_2$ by 11 in., 16 pages. Austin-Western Road Machinery Company, Aurora, Illinois.

Rolling Doors—A new catalog of rolling doors and shutters, hand and motor operated, gives descriptions of types, full tables of dimensions and clearances and illustrations of installations. $8^1/_2$ by 11 in., 8 pages. Cornell Iron Works, Inc., Long Island City, N.Y.

Screenings Shredder—The Rex Triturator, which is claimed to be new in design, in principle and in performance, is described in an 8 page, $8^1/_2$ by 11 in. illustrated folder. Chain Belt Company, Milwaukee, Wis.

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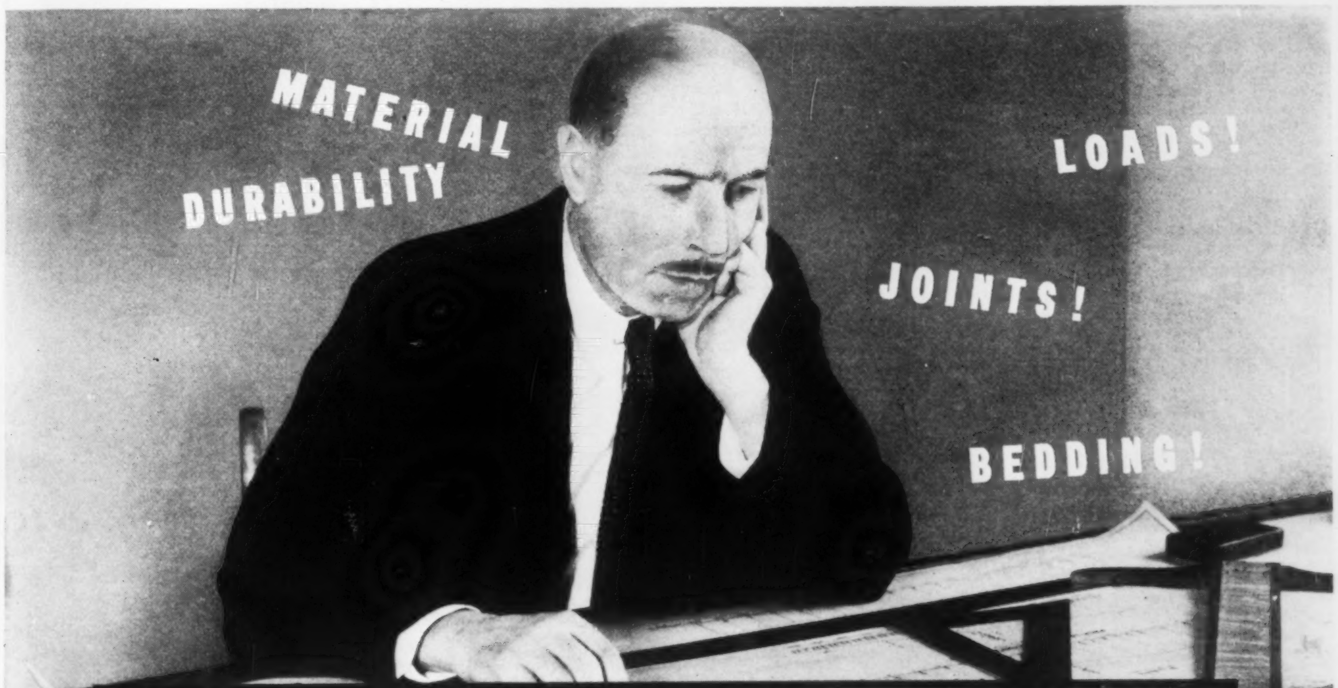
THIS ENGINEER HAS DISCOVERED

AN IMPORTANT FACT ABOUT SEWERS


MATERIAL DURABILITY
LOADS!
JOINTS!
BEDDING!

HE SAYS . . . "In the past many of us have been so concerned about *material* durability that we have practically overlooked the second and *most frequent* cause of sewer failure; namely, *structural weakness*. Yet the most durable material in the world is absolutely worthless for sewers, unless it can be made to function efficiently as a structure. Past experience proves that."

● Guided by this same logic, many cities are specifying corrugated metal pipe for sewers — especially in the larger diameters. Besides saving time and money in installation, this strong, flexible pipe definitely eliminates the worry of structural failure. This fact is proved by 40 years of experience.

What About Material Durability?

Here's where *Asbestos Bonded* Armco pipe solves your problem. This improved corrugated pipe is made of the same highly refined iron which is showing such remarkable durability in sewers laid nearly 30 years ago. In addition, it is paved and fully coated with a special bituminous material, permanently "*bonded*" to the pipe by a special Armco process. Mail the coupon for complete information. Armco Culvert Manufacturers Association, 703 Curtis St., Middletown, Ohio.

ASBESTOS BONDED

ARMCO

PAVED INVERT PIPE

ARMCO

☐ **Show me how I can design against *both* causes of sewer failure with Asbestos Bonded Armco Pipe.**

Name ______________________________

Title ______________________________

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WYCKOFF
Since 1855

REDWOOD PIPE LASTS LONG AND SAVES MONEY

It has 14% greater carrying capacity than metal pipe; Resists frost where severe winters raise havoc with metal pipe. Redwood is the greatest Rot and Heat Resisting Wood known. Can be laid above ground or buried without danger. Not affected by Electrolysis, soil conditions, worms, insects, or the famous termite of the tropics. It does not fill up or corrode; weighs about 1/3 as much as metal pipe and more easily installed. Neither contracts nor expands with heat or cold. Can be laid in wettest kind of trench. Wyckoff Redwood Pipe made of all Clear Heart Stock California Redwood (no knots or sap), in sizes of 1" and up, maximum lengths 12 feet, tenon and socket joints, for pressures to 172 pounds, is used extensively for Water Supply Lines, Penstocks, Sewage, Chemicals, Paper Mills, Tanneries, Fisheries, Mines and Fume Stacks. We can furnish selected Canadian White Pine or Oregon Fir Wood Pipe if specified. We also manufacture Underground Wooden Steam Pipe Casing. Carload shipments can be made one day after receipt of order.

A. WYCKOFF & SON COMPANY, *Office and Factory,* **60 Home Street, ELMIRA, N. Y.**
The Originators of Machine Made Wood Pipe *Catalogue and Specifications Furnished on Request*

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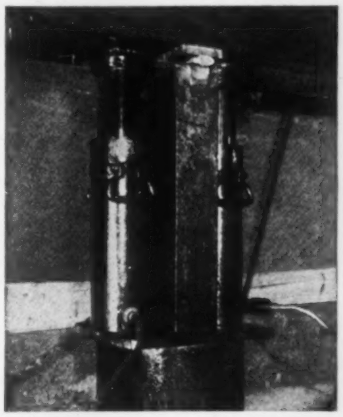


OVERLOAD TO MINIMIZE SETTLEMENT

Pretest underpinning places an overload, usually 50% in excess of the permanent load, upon the underpinning cylinders and **maintains this full test load** until the underpinning is completed.

This patented Pretest method is an exclusive feature of Spencer, White and Prentice foundation service.

FOUNDATIONS
PRETEST UNDERPINNING
PATENTED
SPENCER, WHITE & PRENTIS
NEW YORK **DETROIT**

SEWAGE

Efficient operation of the present-day sewage treatment works demands ACCURATE and DEFINITE knowledge of all rates of flow.

Simplex Venturi Type Meters have been particularly adapted and designed for the measurement of raw or settled sewage, sewage-sludge, and air.

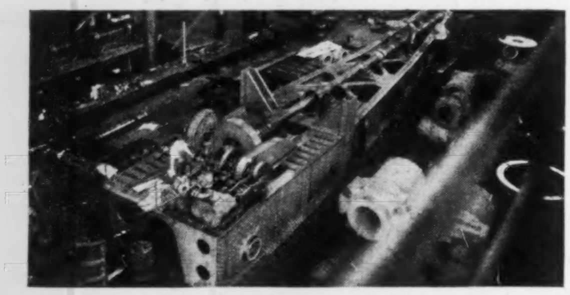
Their use will aid YOU in your plant operation.

Let Simplex Engineers help you in the design of your new plant or in the modernization of your present one.

SIMPLEX VALVE & METER CO.
6719 UPLAND STREET, PHILADELPHIA, PA.

Ships . . . and Shoes and Sealing Wax–

(well, not exactly, but almost)



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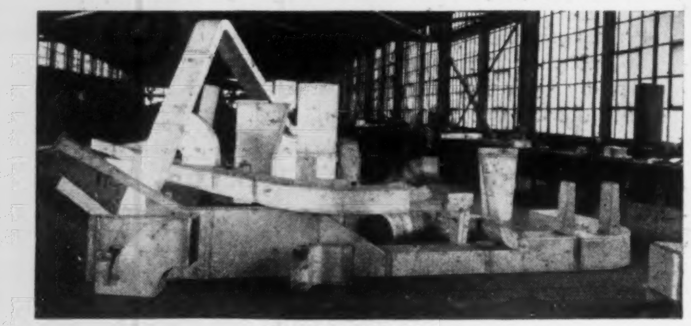

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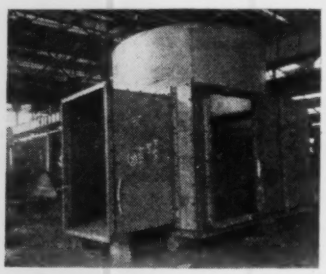

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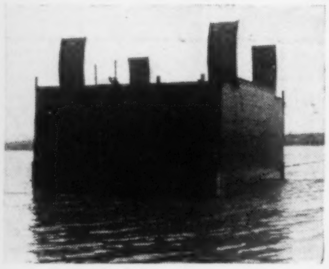

TUNNEL CAISSON

DREDGE SPUDS

THE LIFE OF A SHIPBUILDER isn't all plates and rivets—or even ships. We make all manner of things—hundreds of them. We can tell you all about it if you will get in touch with us.

FEDERAL SHIPBUILDING AND DRY DOCK COMPANY

Lincoln Highway, Kearny, New Jersey

UNITED STATES STEEL

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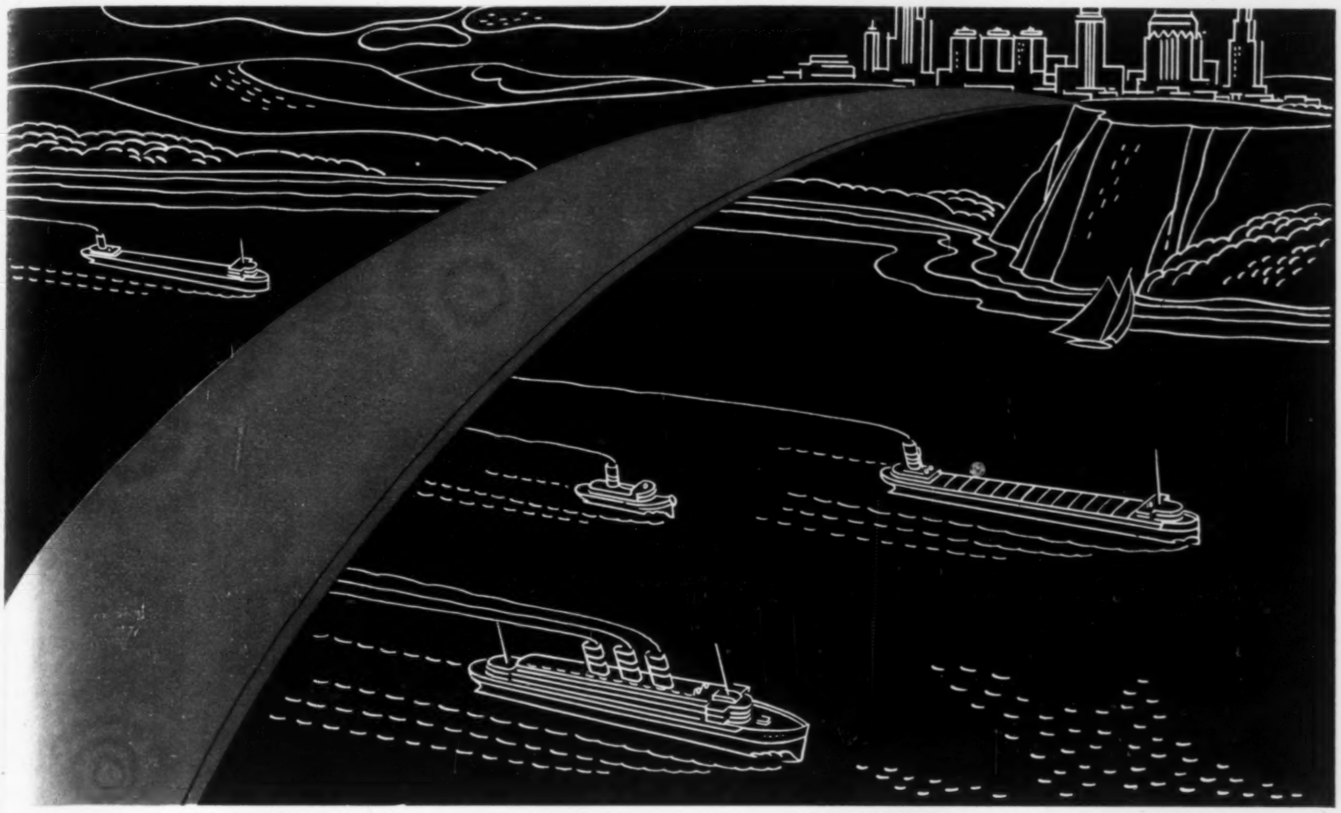

this floor...will make a new chapter in bridge history

● A bridge floor system, built completely of strong alloys of Alcoa Aluminum, is capable of saving so much dead weight that the engineer who first incorporates it into a new bridge will write a new chapter in bridge economics.

Because the great weight saving of the Alcoa Aluminum floor system has such far-reaching effect upon the whole supporting structure, spans not now feasible, because of cost, take on practical possibilities.

The economics of the supporting structure for span-lengths now extant are similarly affected by this inherent weight saving of Alcoa Aluminum.

The introduction to this new chapter in bridge history has already been written in noteworthy reconstruction projects, familiar to most engineers. The main chapters have been outlined in the fundamental principles of design which have been developed by our staff.

If the opportunity to study the indicated possibilities for basic economy appeal to you, this is a forthright and sincere invitation to avail yourself of the professional co-operation of our staff. ALUMINUM COMPANY OF AMERICA, 2127 Gulf Building, Pittsburgh, Pa.

ALCOA·ALUMINUM

CAST IRON PIPE is the preferred material today for permanent installations for reasons which have held good for more than two centuries—the strength and corrosion-resistance of the metal. We have improved the metal structure by our Super-de Lavaud Process of centrifugal casting in a metal mold *without chill.* We have developed linings, coatings and alloys for exceptional requirements, such as super-corrosive soils, waters and industrial processes. But with all that science and invention have contributed to the manufacture of U. S. Pipe, the two principal advantages of Cast Iron Pipe today are essentially native to the metal—great compressive strength and high resistance to corrosion.

U.S.
cast iron
PIPE

Cast iron and alloy cast iron pipe centrifugally or pit cast—for water works, gas, sewerage and drainage service as well as industrial uses involving corrosives.

U. S. PIPE & FOUNDRY CO.
BURLINGTON, NEW JERSEY
Foundries and Sales Offices throughout the U. S.